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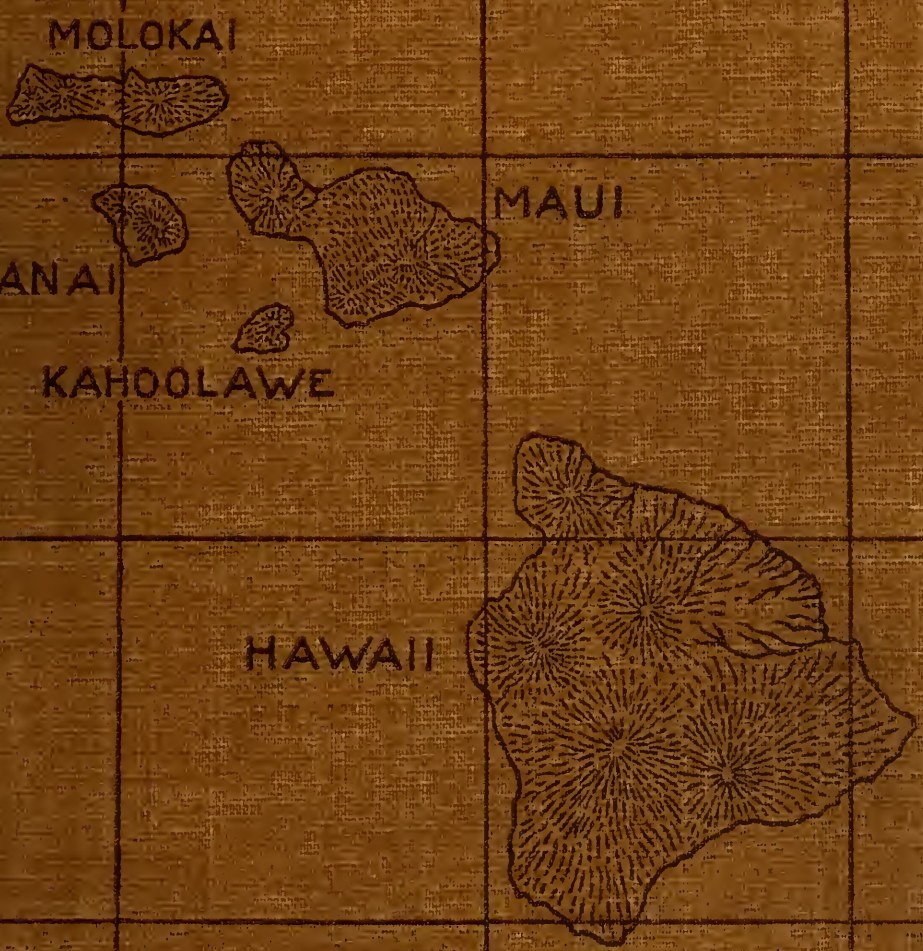
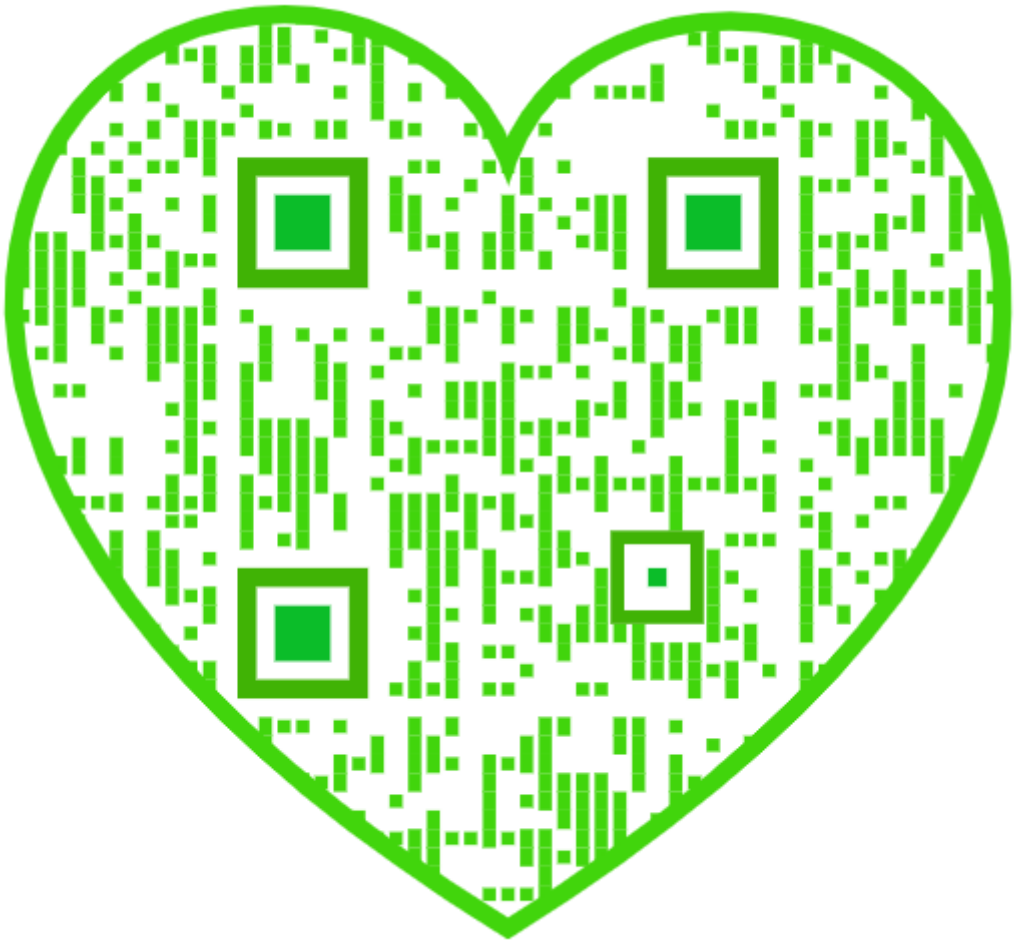
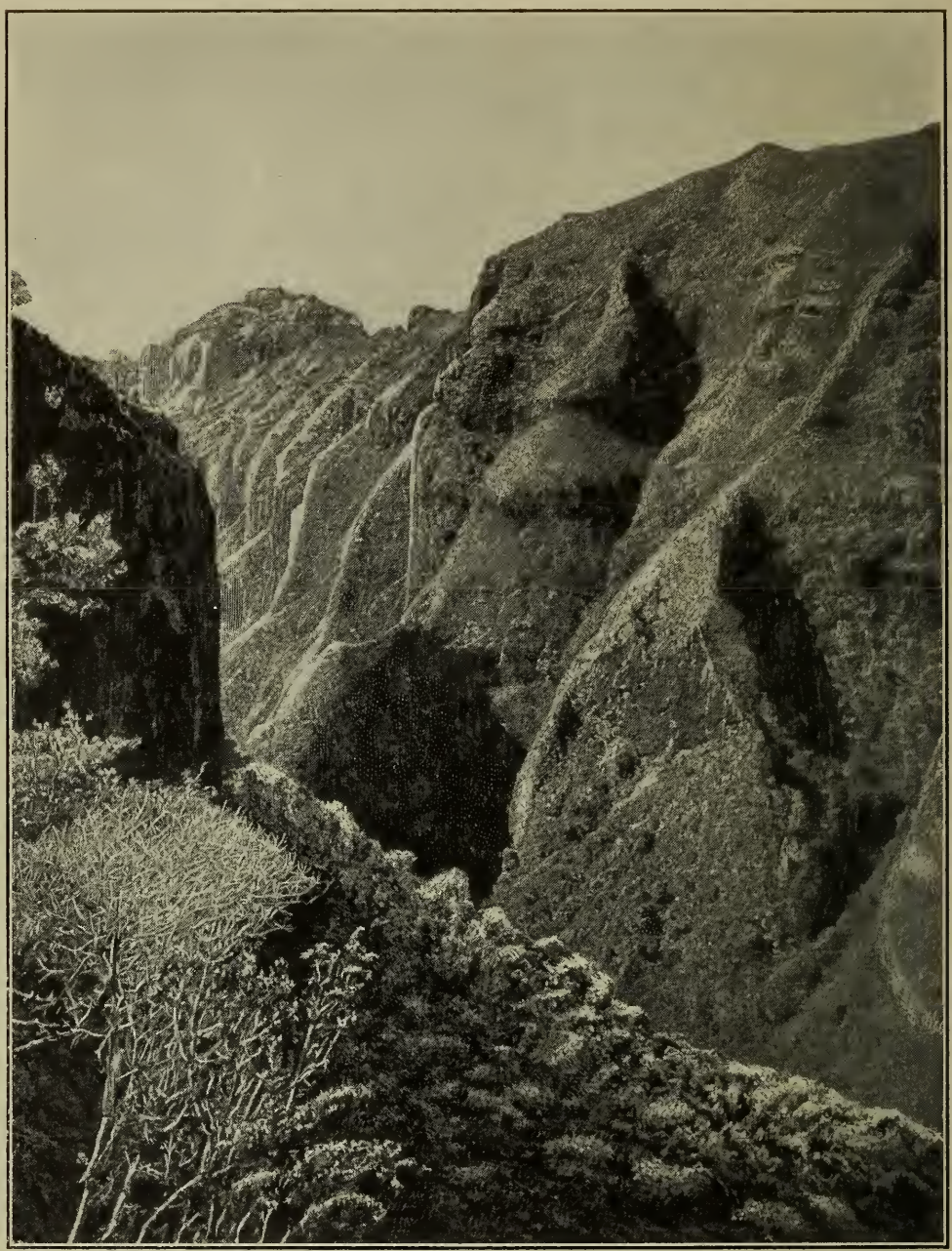
GEOGRAPHY OF THE HAWAIIAN ISLANDS

CHARLES W. BALDWIN







OLOKELE CANYON, ISLAND OF KAUAI.

GEOGRAPHY

OF THE

HAWAIIAN ISLANDS

BY

CHARLES W. BALDWIN

NEW YORK ·:· CINCINNATI ·:· CHICAGO
AMERICAN BOOK COMPANY

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GEOG. H. I.

W. P. I

PREFACE

This text on the Geography of the Hawaiian Group may be styled the first book of its kind that has been published, as the old Barnes' edition was hardly a geography in the true sense of the word. Thus it is that, lacking any previous criterion, the author has had to rely on teaching experience in determining the general nature and scope of the work.

The maps have been specially prepared for this Geography, and are the only up-to-date maps of the Hawaiian Group. The relief maps are the work of Mr. W. T. Pope of our Agricultural College; they have been prepared under expert supervision, and portray physical features not shown heretofore on any map.

In view of the fact that there has been a lack of accurate data on the Hawaiian Group, it has seemed necessary to conform the text to the interests of the teacher as well as to the requirements of the pupil. The book is designed primarily as a source of information whereby the subject may be presented *topically*. With this end in view the Appendix includes a number of references. However, the book may well be placed in the hands of pupils above the fourth grade. In the earlier grades it is expected that the teacher will adapt the subject-matter to the class to conform to the Course of Study.

In the preparation of this book on Hawaiian Geography, the author is much indebted to Mr. Edgar Wood of the Honolulu Normal School, who has furnished valuable data.

CHARLES W. BALDWIN.

HONOLULU.

CONTENTS

	PAGE
INTRODUCTION	7
OAHU	34
HAWAII	51
MAUI	87
MOLOKAI	105
LANAI	109
KAHOOLAWE	109
KAUAI	110
NIIHAU	121
APPENDICES:	
A. Capes, Bays, Mountains, Places, and Plantations	123
B. Distances from Honolulu	126
C. Width of Channels	126
D. Area and Population	127
E. References to Hawaiian Geography	127
F. Pronunciation of Hawaiian Words	128

MAPS

	PAGES
HAWAIIAN ISLANDS	8
PACIFIC OCEAN	26
OAHU	32, 36
HAWAII	50, 54
MAUI	88, 92
MOLOKAI	106
KAUAI	110, 111

GEOGRAPHY OF THE HAWAIIAN ISLANDS

INTRODUCTION

The Hawaiian Islands are a part of an archipelago in the North Pacific, extending from the island of Hawaii on the extreme southeast to Ocean Island on the northwest — a distance of about 2000 miles. With the exception of Necker Island, the islands northwest of the main group are coral atolls, many of them barely rising above the surface of the sea, being hardly more than reefs or sand banks. The largest of these islands is Midway Island, which is a low coral atoll nearly 18 miles in circumference, inclosing several small islands; it is prominent as the landing for the Pacific cable. These islands are probably the topmost peaks of a range of mountains extending northwest and southeast; they have been named as follows: Necker Island, French Frigate Shoals, Gardner Island, Dowsett's Reef, Maro Reef, Laysan Island, Lisianski Island, Pearl and Hermes Reef, Midway Island, Ocean Island.

The Hawaiian Islands proper consist of a group of twelve islands lying between latitude 18° 55′ and 23° north, and longitude 154° 40′ and 162° west. They are about 2100 miles from San Francisco, and 4700 from Manila. Eight of these islands — Hawaii,[1] Maui, Oahu, Kauai, Molokai, Lanai, Niihau, and Kahoolawe — are inhabited, the remainder — Molokini, Lehua, Kaula, and Nihoa (Bird Island) — being but barren rocks. The eight inhabited islands are named above in the order of their size.

[1] For pronunciation of Hawaiian names, see Appendix F.

160°
159°30′
159°
158°30′
Longitude
158°
West
Haena Pt.
Hanalei
NAPALI
KAUAI
Kealia
Kapaa
WAIALEALE
Mana
Lihue
Kumukahi Channel
LEHUA
22°
Nano
papa
Ki
KAEO
Pueo Pt.
Waimea
Hanapepe
Koloa
Nawiliwili B.
NIIHAU
Kawaihoa Pt.
Hanapepe R.
KAULA
KAIEIE WAHO OR KAUAI CHANNEL
Kahuku
Laie
Waialua
Kaena Pt.
WAIANAE
Kaneohe
Barber's Pt.
HONOLULU
Leahi or Diamond Head
Kaiwi Channel
21°
30′
21°
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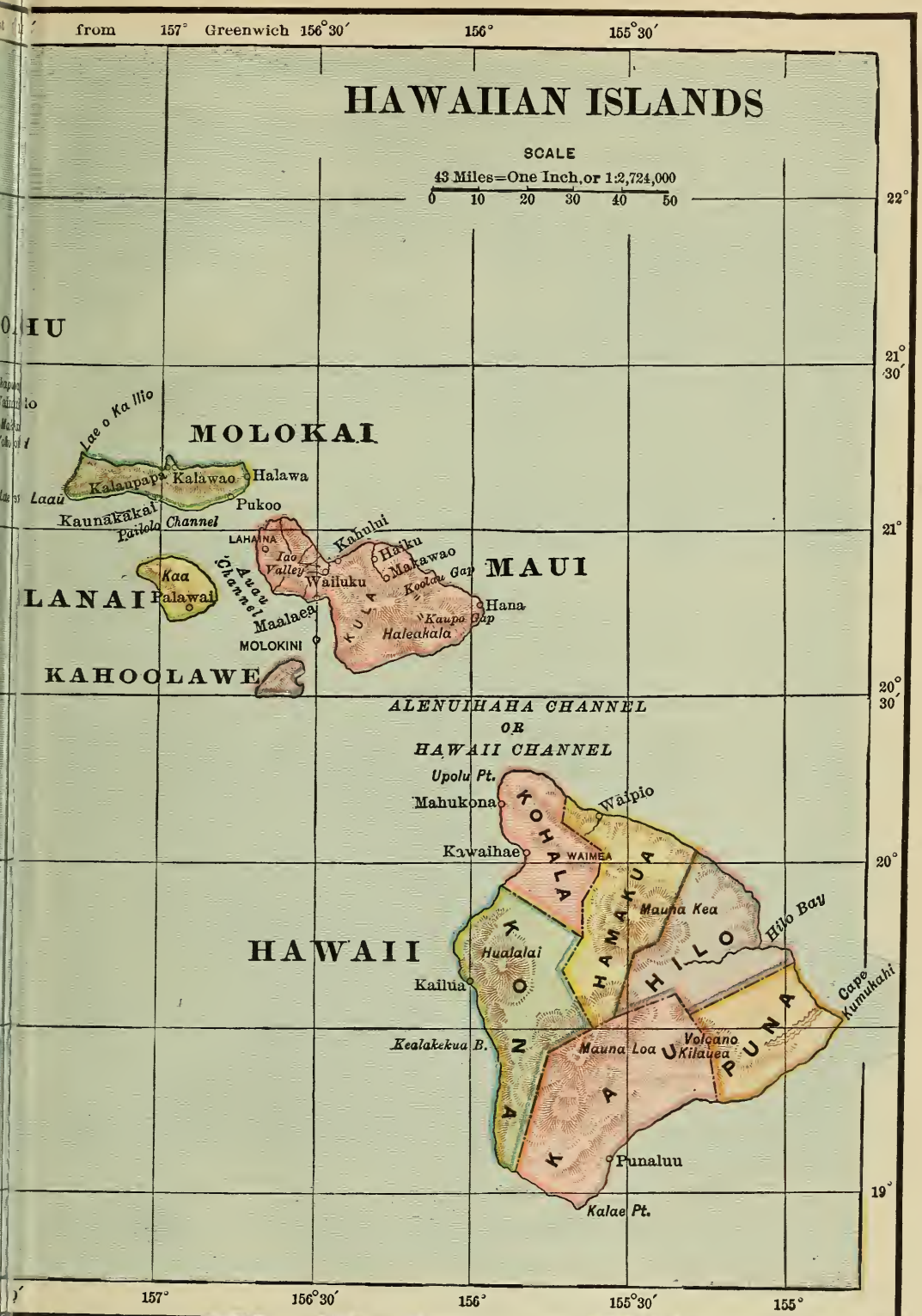
from 157° Greenwich 156°30′ 156° 155°30′
HAWAIIAN ISLANDS
SCALE
43 Miles=One Inch, or 1:2,724,000
0 10 20 30 40 50
22°
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157° 156°30′ 156° 155°30′ 155°
HU
MOLOKAI
Lae o Ka Ilio
Kalaupapa
Kalawao
Halawa
Laau
Pukoo
Kaunakakai
Pailolo Channel
LAHAINA
Iao Valley
Kahului
Haiku
Makawao
Kaupo Gap
Wailuku
MAUI
Hana
KULA
Haleakala
LANAI
Kaa
Palawai
Auau Channel
Maalaea
MOLOKINI
KAHOOLAWE
ALENUIHAHA CHANNEL
OR
HAWAII CHANNEL
Upolu Pt.
Mahukona
Waipio
KOHALA
Kawaihae
WAIMEA
HAMAKUA
Mauna Kea
Hilo Bay
HILO
HAWAII
Hualalai
Kailua
KONA
Kealakekua B.
Mauna Loa
Volcano Kilauea
KAU
PUNA
Cape Kumukahi
Punaluu
Kalae Pt.

The Hawaiian group, which formed along a fissure in the earth's crust, extending northwest and southeast, consists of craters built up from the bottom of the ocean by outpoured lava.[1]

The volcanic fires ceased first on Kauai, and so, as it became greatly eroded and acquired more forms of plant life, it has been called the oldest island of the group; this does not mean, however, that it appeared above the surface of the ocean first, or even before Hawaii, the youngest island, which, with its two active volcanoes, is still in the making process, though it has already been built up 8575 feet higher than Kauai.

The surface features of the group are characterized by lofty mountains with gentle slopes, which are cut up by many gorges of great depth. The valleys of West Maui and Kauai are among the grandest in the world. The windward or northeast sides terminate in cliffs, which, on Hawaii and Molokai, are several thousand feet high in places. The upper slopes of the mountains are covered with a dense tropical growth of great beauty, which extends nearly to the sea on the windward side.

Situated as they are at the crossroads of the steamer routes across the Pacific, the Hawaiian Islands occupy a position of great commercial and strategic importance — and thus well merit the epithet which is applied to them, "The Key of the Pacific."

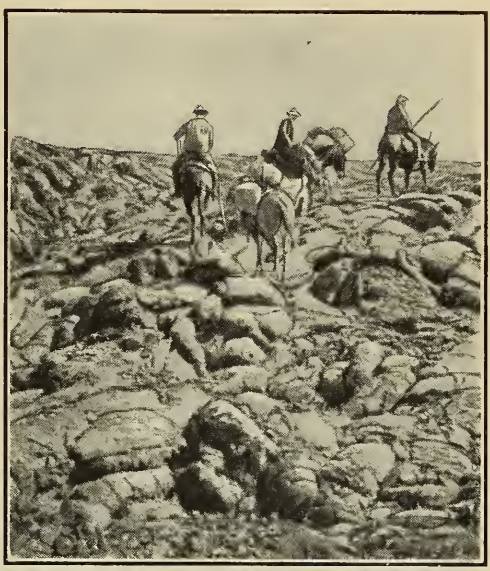
Rock. — With the exception of some uplifted coral reefs, and a little sandstone and sedimentary rock, all the rock of the group is volcanic, consisting of basaltic lavas.

This volcanic rock may be divided into two general classes: (1) completely fused lava (pahoehoe and aa), and (2) that which has been ejected in particles of various sizes and shapes (tufa); in many cases this latter was in a partly fused mass, or contained cementing material which bound it into loose, friable rock.

Pahoehoe and aa are similar in composition and may be parts of the same flow. Aa presents a rough, jagged appearance,

[1] "Hawaiian Islands, How Formed," C. W. Baldwin, *Hawaii's Young People*, February, 1898 (1899 on outside cover).

while pahoehoe is smooth lava. Pahoehoe is the natural form for lava to take in cooling, and just why lava should take the aa shape is a little difficult for us to state.[1] The first part of a lava flow is usually aa, the latter flow being pahoehoe. As pahoehoe presents a smooth, rolling surface, animals can find a path upon it without difficulty, but not so with aa, which presents an impassable barrier.



PAHOEHOE.

The sandstone, which is sea sand cemented by the lime of which it is partly composed, does not make a very durable stone, though it has been used as a building stone in some places.

AA.

The blue lava rock, of which some of the finest buildings in Honolulu are constructed, is a solid, compact pahoehoe.

[1] "Lava Flows of Hawaii" (pahoehoe and aa), C. W. Baldwin, *Hawaii's Young People*, January, 1902.

Soil. — With the exception of a small percentage of vegetable mold, all the soil of the group is formed from the disintegration or weathering of lava rock. This soil may be divided into three classes: (1) lava soil; (2) tufa soil; and (3) sedimentary soil.

Dark red soils are formed by the weathering of normal lavas (aa and pahoehoe) in a warm atmosphere with a small amount of rainfall; as in the regions about Makaweli on Kauai and Paia on Maui, and the uplands of Waialua on Oahu. These dark red soils are always good soils.

We should naturally expect to find nearly all the soil of the group dark red, and this would undoubtedly be true, were it not for the fact that (1) a great deal of the original material has been covered up under the débris of the tufa cones which are so numerous in some localities, and that (2) normal lavas form yellow or grayish yellow soils when the weathering takes place where there is a heavy rainfall.

While tufa has a common source with the other lava rock of the group, yet it differs radically, owing to changes which took place through the action of steam and gases at the time it was ejected. Tufa weathers as light red and yellow soil. Regions covered by tufa soil are the districts of Honolulu, Lihue, and Hilo. These light red and yellow soils are not so good as the dark red soils.

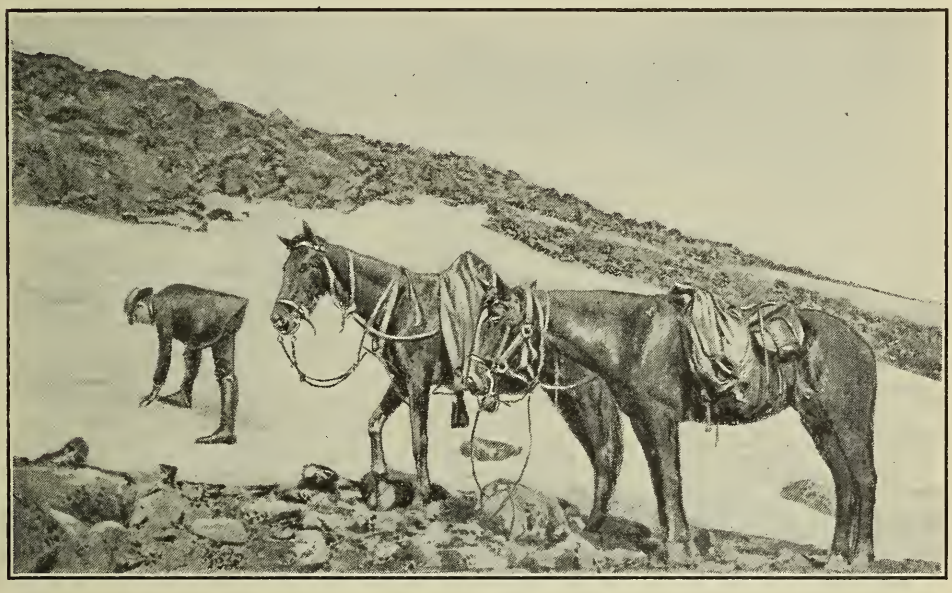
In localities subject to a heavy rainfall the grayish yellow soil, formed from normal lavas, is likely to have lost some of its ingredients, which have been dissolved in water and carried away; this usually forms a subsoil covered by vegetable mold, which is sometimes several feet in thickness, as in Olaa. Where the forests have been cleared away, this subsoil is often exposed by the washing away of the surface layer; which accounts for the poor soil in some of the places on the windward side of the group; as Hanalei on Kauai, Huelo on Maui, and Kaneohe on Oahu.

Sedimentary soils are found in the valley bottoms and along the lowlands of the coastal plain. As the sedimentary soils

generally contain vegetable mold, they are generally of a brown color. They form the best soils of the group. Lahaina on Maui, the Ewa plantation on Oahu, and Kekaha on Kauai are typical sedimentary soil regions.

The action of heat on our soil is to turn it red; hence much of the soil of the group has been burned red by overflows of lava.[1]

Climate. — Owing to the trade winds which blow continuously for nine months in the year, and the currents which cool the



SUMMIT OF MAUNA KEA IN MIDSUMMER.

ocean about the islands, the temperature of the group is 10° lower than that of any other part of the world in the same latitude.[2] At sea level the temperature ranges from 60° to 85°, with an average of about 75°. At an elevation of 1200 feet the temperature is 70°.

The islands are exempt from cyclones or hurricanes, and thunderstorms are rare. During the months of December, January, February, and March the southwest wind blows during

[1] "Lavas and Soils of the Hawaiian Islands," Walter Maxwell.

[2] "Cold Current System of the Pacific," Dr. Bishop, *Hawaiian Annual*, 1905, page 74.

the cessation of the trades. It is the storm wind known as Kona.

As a rule there is a sharp contrast between the northeast or windward side, and the lee or southwest side of the various islands; the former being excessively rainy and the latter extremely arid.

Owing to the height of the islands above sea level a great variety of climate may be found, ranging from torrid heat at sea level on the lee side of the group to a freezing temperature on the snow-capped summits of the highest mountains.

At the Sea Beach in Kona.

On the whole, the climate, which is a remarkably equable one, is as nearly perfect as can be found anywhere in the world. An ideal climate, coupled with its tropical growth, has given the group the sobriquet, " Paradise of the Pacific."

Vegetation. — The upper mountain slopes of the group are covered with a heavy forest growth, which reaches nearly to the seashore on the windward side. At one time these forests extended much lower than at present, but they have been destroyed

to a great extent by cattle and fires, or have given way to cane fields.

The flora of the Hawaiian Islands may be divided into three groups: (1) indigenous plants, which mainly comprise the upper forest growth; (2) those that were brought from the islands farther south by the early inhabitants; and (3) those that were

FOREST IN HAWAII.

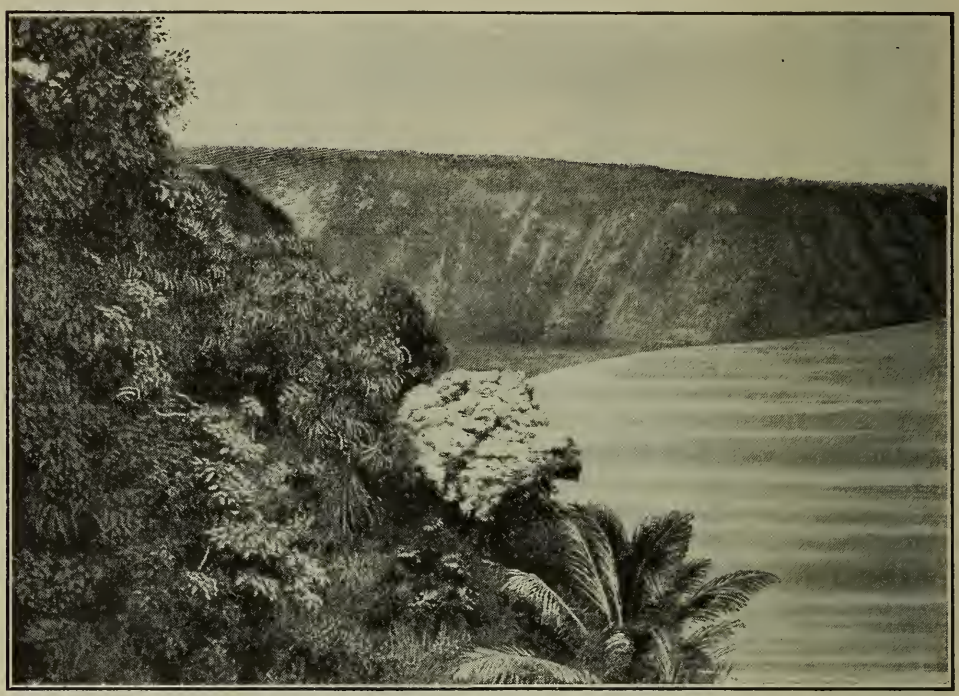
introduced after the islands were visited by Captain Cook in 1779.

Among the trees of the ancient forest there are a number of ornamental and timber woods, as koa, kauila, mamane, and ohia. From the koa, with infinite toil, the Hawaiians hollowed out their canoes, using the light wiliwili, or hau wood, for the outrigger. The heavy, hard wood of the kauila furnished spear and oo handles and kapa beaters. From the fiber of the olona shrub, cord was made for fish lines and nets.

The only woods from the original forest trees that are of any commercial value now are the koa (Hawaiian mahogany), which

is used in the finest cabinet work, and ohia, large quantities of which are exported for railroad ties. A great many young sandalwood trees have sprung up in the forests, but not in sufficient quantities to warrant a revival of the trade which nearly resulted in their extermination.

The plants introduced by the ancient Hawaiians form a very interesting group, as they not only determined the future agri-



KUKUI AND HALA ON WAIPIO CLIFF.

cultural pursuits of the group, but indicate the purpose and direction of the early voyages. Among these plants are the breadfruit, cocoanut, banana, taro, sugar cane, ohia (so-called mountain apple), mulberry, hala, hau, kukui, milo, and kamani, which yielded food and material for cloth, rope, mats, and other domestic articles.

The lower forests are composed of kukui (candle-nut tree), hau, and hala; the leaves of this last-named tree furnish the material from which the mats and hats are woven that are so common about the islands. On the lowlands adjoining the

HOOKENA BEACH, HAWAII.

beach or in the sand of the beach itself, groves of cocoanut grow.

When the islands were discovered there were but few fruits and vegetables to be found. Of the fruits introduced many are now to be found growing wild, as the guava, orange, lime, mango, Cape gooseberry (poha), and others.[1]

Territorial and Federal agricultural and forestry bureaus have been established, with stations in Honolulu, under whose direction forest reserves have been constituted, and which are actively engaged in reforesting tracts of public and private domain. This reforesting is being done with several varieties of eucalyptus, algaroba, silver-oak, black wattle, monkey-pod, and ironwood. Of these the eucalyptus grows well on the windward slopes and the algaroba on the low, dry spots near the seashore on the lee side of the group; the latter tree is not only a valuable firewood, but also furnishes in its seed pods fodder for cattle and horses.

Animals. — At the time of Captain Cook's visit in 1779, hogs, dogs, mice, domestic fowls, lizards, and a few harmless insects

[1] "Agricultural Resources and Capabilities of Hawaii," William C. Stubbs, Ph.D., page 27.

were found, but by far the greater proportion of animals were birds, of which there were about seventy varieties — comprising a number of small forest birds, waterfowl, beach and sea birds.

In 1793 Vancouver landed cattle, sheep, and goats; and horses were brought later. Some of these animals are now found in a half-wild state on parts of the group.

During the months from November to March flocks of ducks, plover, and curlew migrate to these shores from the northwest coast of America.

Owing to the recession of the forests to the higher mountain slopes, the forest birds are fast disappearing. The mamo, from which the finest feathers were procured for the famous feather cloaks of the chiefs, has long been extinct.

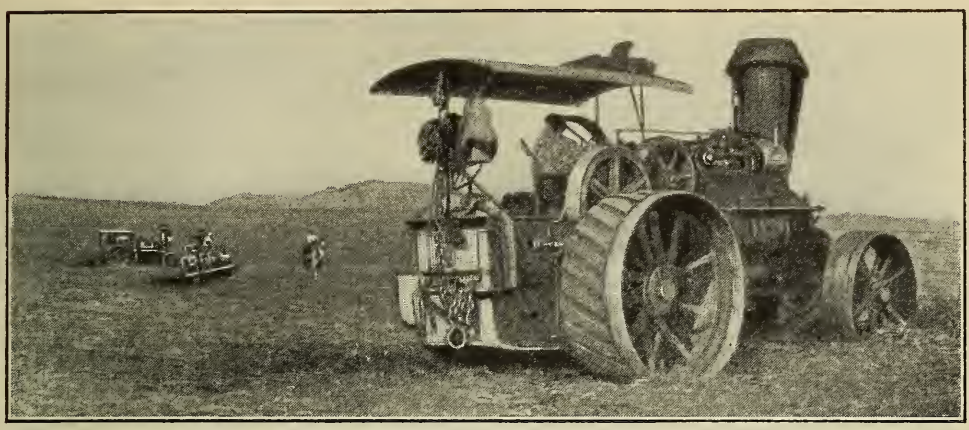
Through the indiscriminate introduction of plants from other countries, a number of injurious blights and insects have been brought into the Territory. These have multiplied in great numbers, threatening to destroy many forms of plant life, including some of the staple products of the islands. However, natural insect enemies of these pests were searched out and distributed about the group, and so they have been kept in check. The most destructive of these pests are the cottony cushion scale, the leaf-hopper, the Japanese beetle, the army worm, and the cane-borer.

To replace the disappearing, insect-eating forest birds, a number of birds have been introduced, such as the mynahs, turtle-doves, larks, rice birds, sparrows, and quail.

On the leaves of forest trees and shrubs or in the shrubbery on the ground are found 341 species of land shells (achatinella). These achatinella are peculiar to the Hawaiian group, and excel in beauty of form and color the land shells of any other part of the world. The largest number are found on the island of Oahu.[1]

Industries. — The sugar output includes 96 per cent of the value of the industries of the group, which are almost entirely agricultural. There are now about fifty plantations on the islands, which in 1907 had an output of 411,007 tons of sugar.

[1] "Land Shells of the Hawaiian Islands," D. D. Baldwin, *Hawaii's Young People*, May, 1900.

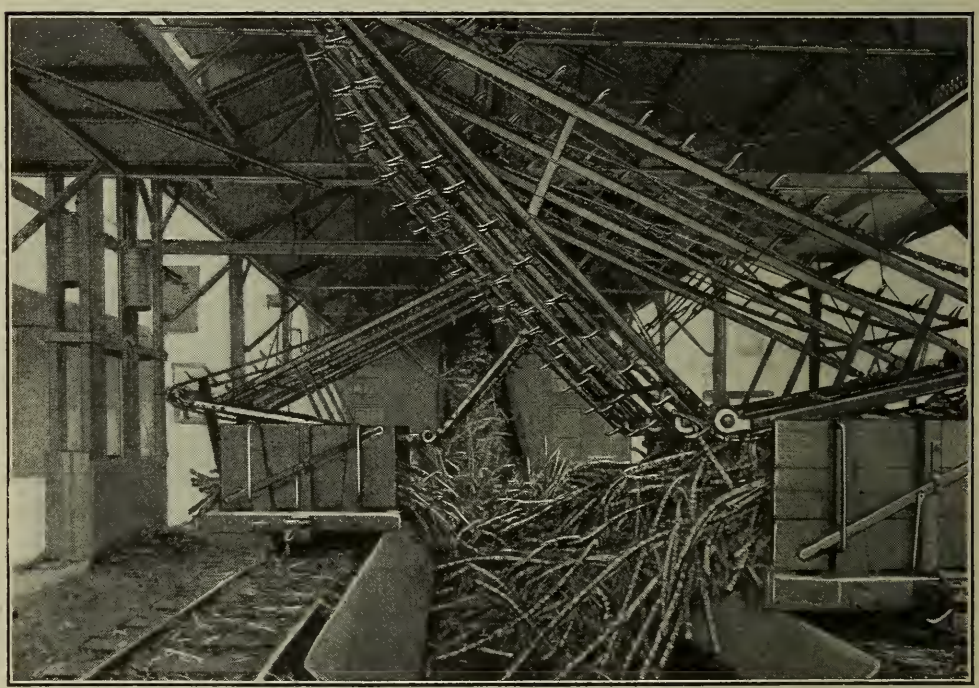


STEAM PLOWS AT WORK.

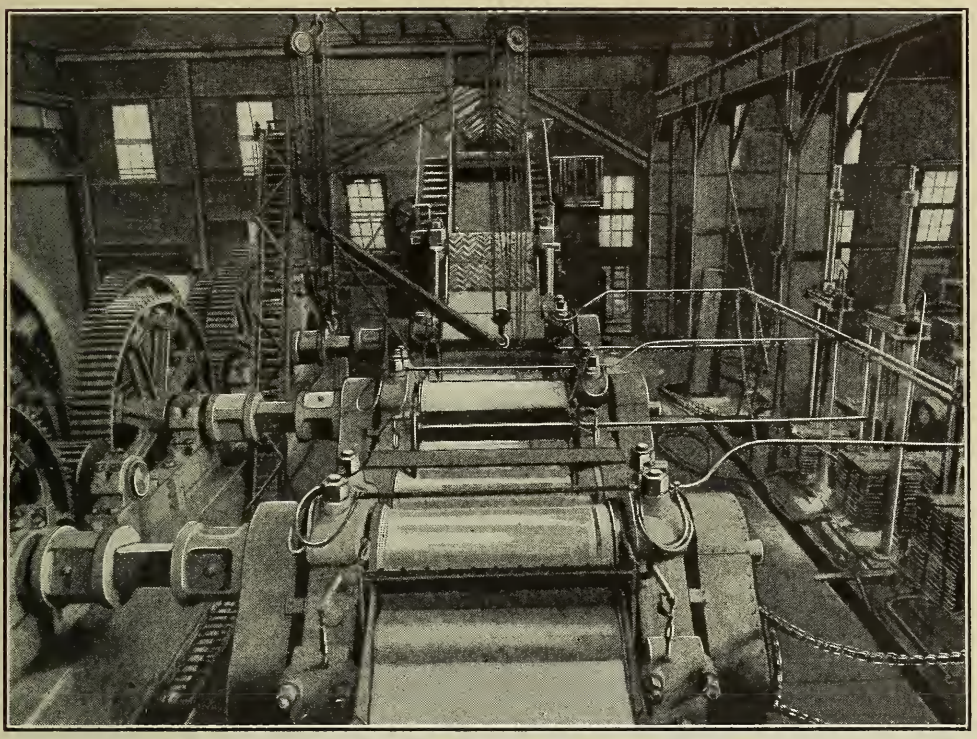
PLANTING CANE FIELD.

CUTTING CANE.

LOADING CANE CARS.



UNLOADING CANE ON CARRIER.



CANE-CRUSHING MACHINERY.

MILL INTERIOR — BAGGING SUGAR.

Hawaii is, no doubt, the most advanced sugar-producing country of the world. While this is due in part to the introduction of improved methods of harvesting and milling, the result has been chiefly brought about by the efforts of the Planter's Experimental Station in devising the best methods of fertilizing and cultivating sugar cane.

This experimental station, which is located in Honolulu, is one of the most efficiently equipped and organized experimental stations in the world. It is maintained at a yearly cost of $60,000.

Most of the plantations have complete systems of railway tracks which connect the mills with the fields and landings. Where water is plentiful, as on the windward side of Hawaii, the cane is flumed to the mill. When the mountain slope is abrupt, gravity roads and overhead trolley cables are used.

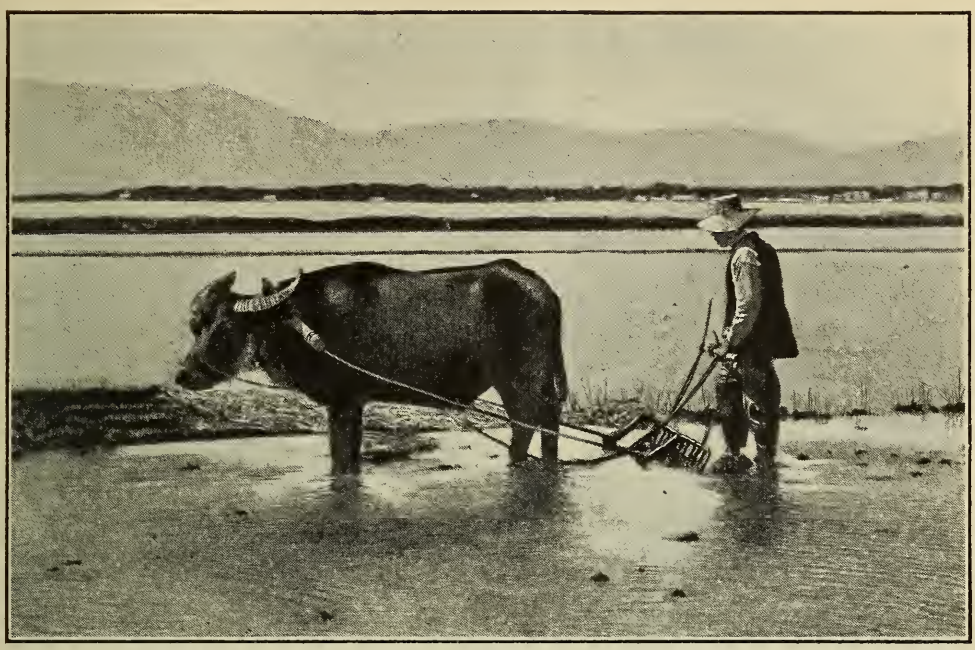
Water has been conveyed through miles of irrigation aqueducts to dry sections, so that nearly all of the arable land of the group is now under cultivation. These ditches, traversing, as they do, the most inaccessible regions of the group, represent great feats of engineering. The water is carried over the gulches through huge siphon pipes, and along inaccessible precipices in a series of tunnels within the rock face of the cliff. The big ditches have a daily capacity of from 30,000 to 80,000 gallons of water.

In places wells have been sunk and water forced by powerful pumps through long lines of pipe to higher levels. In other sections water has been sought by tunneling into the mountains.

With the exception of the cane raised on the windward side of the island of Hawaii, all of the sugar cane of the group is grown by irrigation; the northeast side of Hawaii has sufficient rainfall to raise cane without irrigation.[1]

Rice comes next to sugar in the area of production and value. It is grown in the valleys and on the flat lands near the sea. This industry is almost entirely in the hands of Chinamen, who

[1] "Sugar: Its Status and Development," L. A. Thurston, *Jubilee Number Advertiser*, page 31, July 2, 1906.



PREPARING RICE FIELD.

COFFEE ORCHARD.

PINEAPPLE FIELD.

PINEAPPLE CANNERY.

employ the most primitive methods in cultivating and harvesting their crops.[1]

Coffee grows well in sheltered parts of the group, and yields a berry equal to the best Java or Mocha; this is known as Kona coffee. Owing to the low market price, many of the coffee orchards have been abandoned. Coffee is chiefly raised on the island of Hawaii.

Pineapples are planted in various parts of the group, where factories have been established for canning the fruit. The Hawaiian canned pineapple is of a very high grade.

Rubber producing is an important industry in sections. Sisal, tobacco, vanilla, bananas, oranges, limes, are also grown, and bee culture is carried on in places.

The lands of the group not used for agricultural purposes are occupied by cattle and sheep ranches.

The ocean about the group abounds in fish. In artificial ponds along the shore mullet are raised.

Commerce. — Three of the great trans-Pacific steamship routes touch at Honolulu — from San Francisco to Yokohama and Hongkong, from Vancouver to Auckland and Sydney, and from San Francisco to Auckland and Sydney. Besides the foregoing, there are independent lines running from Honolulu to Hilo and Kahului, and from Honolulu to San Francisco and the Isthmus of Tehuantepec.

Also there is a large fleet of freighters which brings breadstuffs, grain, oil, machinery, and manufactured articles from the Pacific and Atlantic ports, lumber from Puget Sound, and coal from Newcastle, New South Wales.

The cable of the Commercial Pacific Cable Company lands at Waikiki, where it is connected by overland wire with Honolulu. The larger islands of the group are connected by wireless telegraph.

History. — The Hawaiians are Polynesians, who came from the southeastern Asian archipelago, gradually spreading throughout the islands of the South Pacific and finally reaching Samoa. The

[1] "Agricultural Resources and Capabilities of Hawaii," Wm. C. Stubbs, page 44.

120
140
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ARCTIC CIRCLE
A S I A
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SEA
Dutch Harbor
ALEUTIAN
IS.
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Yokohama
CHINA
Shanghai
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OCEAN I.
MIDWAY IS.
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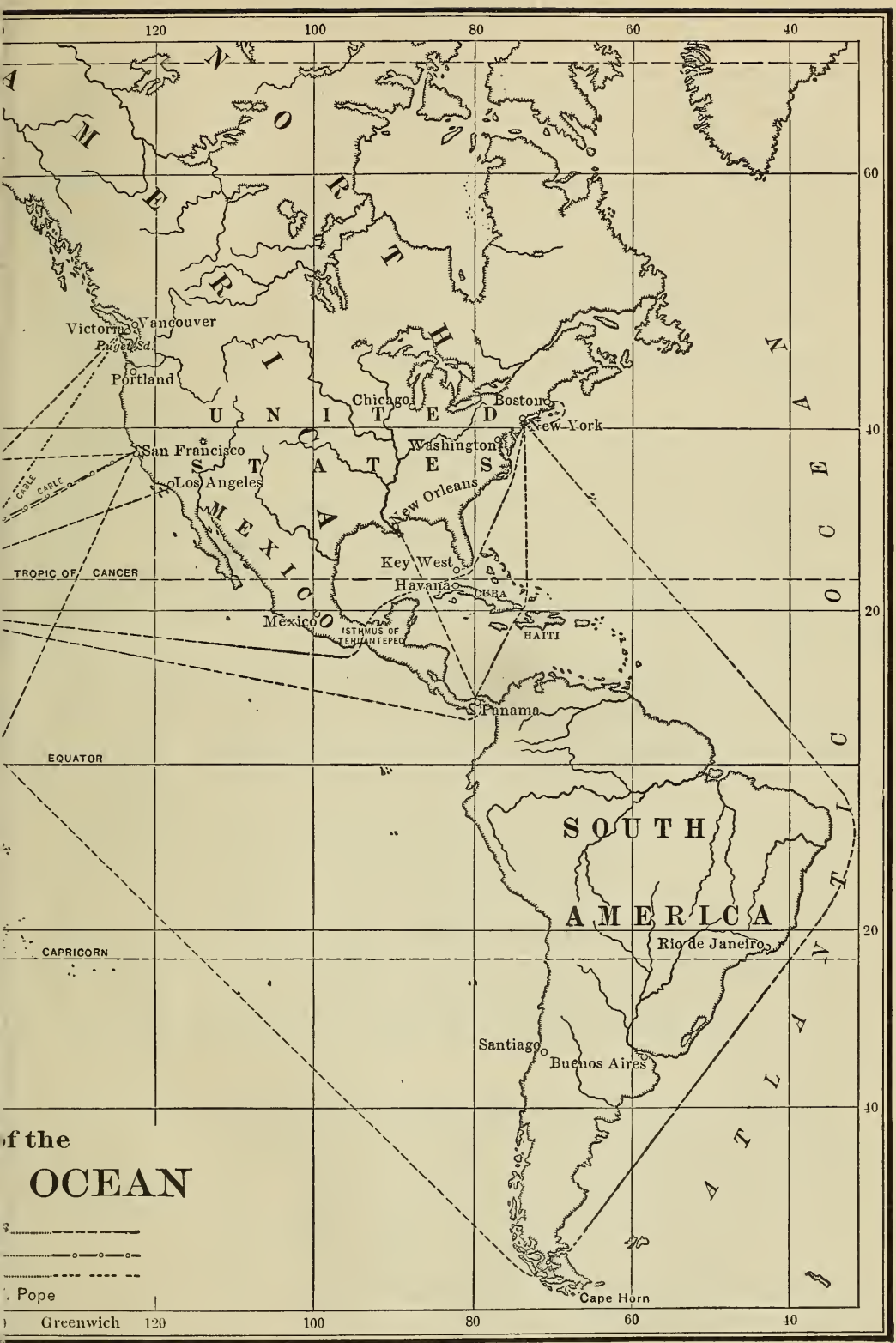
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60
40

first migrations to Hawaii were probably about the sixth century, from the Society Islands. These early people were bold, skillful seamen, sailing by the stars. They built large double canoes capable of carrying provisions for a long voyage. Voyages were frequently made between Hawaii and Samoa, and between Hawaii and Tahiti, whence the population was increased and new plants and animals introduced.

After a time communication with the south ceased, and then for several centuries the group was cut off from the rest of the world.

In 1555 the Spanish visited the group, but kept their discovery secret. In 1778 Captain Cook found the islands, and their existence was then made known to the world. He named them Sandwich Islands for his patron, the Earl of Sandwich. Cook first landed at Waimea on Kauai; on a later visit he was killed in a quarrel with the natives at Kaawaloa in Kealakekua Bay on Hawaii.

In 1795 Kamehameha, king of Hawaii, united the Windward Islands under one head by the conquest of Oahu; and in 1810 Kauai was formally ceded to him by Kaumualii. Thus the group, which had previously been ruled over by a number of independent petty chiefs, was finally united under one head.

The Kamehameha dynasty continued as rulers until 1874, when by popular election Kalakaua came to the throne.

In 1819 idolatry was abolished. The following year, 1820, the American missionaries arrived. They immediately reduced the language to writing, organized the present school system, and were actively instrumental in creating a constitution and establishing laws.

In 1876 a reciprocity treaty was concluded with the United States, by which, for the cession of Pearl Harbor, sugar was admitted free of duty to the United States. This immediately gave a tremendous impetus to the sugar industry, and caused the country to prosper to a greater degree than ever before; and was the chief factor in making possible the annexation of the Hawaiian Islands later.

Upon King Kalakaua's death, Queen Liliuokalani came to the throne in 1891. About two years after her accession to the throne, she attempted to force a new constitution on the people, restoring the old powers of royalty. This resulted in an uprising: the queen was deposed and a provisional government established. Upon the failure to secure annexation to the United States through the opposition of President Cleveland, the Republic of Hawaii was organized July 4, 1894, with Sanford B. Dole as President. On the 12th of August, 1898, annexation to the United States was finally accomplished and in 1900 the islands were organized as the Territory of Hawaii.

Population. — In 1900 the population of the group numbered 154,000. It was estimated at 157,300 in 1907. When the islands were discovered, the population was probably about 250,000; in 1878, it had fallen away to 57,985. The years following this show a very rapid increase in population, brought about by the importation of laborers to meet the growing needs of the planters, due to the impetus given to the sugar industry by the reciprocity treaty. These laborers were brought in under the contract system, and were chiefly Chinese, Japanese, and Portuguese.

Of the present population 58 per cent are Orientals; 22 per cent Hawaiians and those of Hawaiian extraction; and the remaining 20 per cent are evenly divided between Americans, Portuguese, and other Europeans.

Government.[1] — The legislative department consists of a senate and a house of representatives. Senators are elected for four years and representatives for two years. The sessions of the legislature are biennial.

The executive branch of the government includes a governor, secretary, superintendent of public works, commissioner of public lands, auditor, treasurer, attorney-general, high sheriff, tax assessor, surveyor, and superintendent of public instruction. Of the foregoing the governor and secretary are appointed by

[1] "Synopsis of the Government of the Territory of Hawaii," *Hawaii's Young People*, October, 1907.

the President, with the approval of the Senate of the United States. The other officials are appointed by the governor, with the approval of the Territorial senate.

The judicial department comprises a supreme court, and circuit and district courts. The judges of the supreme and circuit courts receive their appointments from the President, with the approval of the Senate of the United States, while the district justices are appointed by the governor.

Besides the above, the Federal Government of the United States maintains a circuit judge, a district attorney, a marshal, and a collector of customs and internal revenue.

The Territory elects a delegate to the Congress of the United States, who has a seat in the House of Representatives, but no vote.

The Territory is divided into five counties: Hawaii, Maui, Oahu, Kauai, and Kalawao. Maui includes Lanai, Kahoolawe, and Molokai, except Kalawao County, while Kauai includes Niihau.

Education. — Education is compulsory, free, and universal. The Department of Public Instruction consists of a superintendent and six commissioners, who have control of all educational affairs, public and private, throughout the group. The department is represented in each of the outer districts by a school agent. Three normal inspectors are appointed by the superintendent and commissioners, and are required to report regularly concerning the circuits to which they are assigned.

There is a thoroughly equipped normal school in Honolulu, which includes a training school with a full corps of critic teachers. High schools are maintained at Honolulu and Hilo, and industrial schools for boys at Lahainaluna on Maui, and at Waialee, near Kahuku on Oahu.

A College of Agriculture and Mechanic Arts, established by the Territory at Honolulu in 1908, is maintained jointly by the Territory and the Federal Government.

Besides the public schools there are a number of excellent denominational schools; as Oahu College, the Kamehameha

Schools, St. Louis College, Hilo Boarding School, and (for girls) Kawaiahao Seminary, Maunaolu Seminary on Maui, and the Kohala Girls' School.

Oahu College, which is situated at Punahou in the suburbs of Honolulu, is the most thoroughly equipped school in the Territory. The curriculum of this school includes elementary grades as well as a year of university studies.

The Kamehameha Schools, which were handsomely endowed by the late Bernice Pauahi Bishop, include boys' and girls' schools, which are fully equipped for manual work.

158° 10′
158° 0′
21° 40′
21° 30′
21° 20′
Waimea Bay
HALEIWA HOTEL
Waialua Bay
WAIALUA
Kawaihapai
Kaena Pt.
Mokuleia
Mill
WAIALUA
Makua
WAIANAE
Wahiawa
Mauna Lahilahi
Makaha
Waianae
Waianae Landing
Honouliuli
Ewa Mill
Oahu R.R.
Sisal
Barber's Pt.
158° 10′
158° 0′

157°50′
157°40′
21°40′
21°30′
Point
Kahuku
Laie Bay
Hauula
Punaluu
Kahana Bay
OAHU
Compiled from Govt. Survey Maps
by
Baldwin & Alexander
Civil Engineers
MILES
0 1 2 3 4 5 6 7 8 9 10
Kualoa
Mokolii
Waikane
KANEOHE BAY
Moku Manu
Mokapu Point
Kailua Bay
Mokulua
Olomana
Waimanalo
Rabbit Island
Makapuu Pt.
Honolulu Harbor
HONOLULU
Waikiki
Hanauma Bay
Koko Head
Diamond Head
Leahi or
Aiea
Pearl Harbor
Waianae Range
Koolau Range
Nuuanu Pali
Konahuanui
3105
2775

OAHU

Physical Features.— The island of Oahu lies midway between Kauai and Maui. It contains 598 square miles and is the third in size of the Hawaiian Islands — only Hawaii and Maui being larger.

In general outline this island resembles a four-sided figure, the northeast and southwest sides being parallel. The points of the figure are Kahuku on the northeast, Kaena on the northwest, Barber's Point on the southwest, and Makapuu on the southeast.

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HONOLULU HARBOR.

The shore line of Oahu is much more irregular than that of the other islands of the group. It is this feature which gives the island its prominence as the most important one in the group; for excellent harbors have been thus afforded. On the south there is the bay on which is situated Honolulu, the capital and chief commercial city of the Territory; and Pearl Lochs, the proposed site for the new naval docks.

On the windward side of the island there are the deep inlet at the mouth of the Kahana Valley, and Kaneohe Bay; this latter is inclosed on one side by Mokapu Point and on the other by the Kualoa headland. The so-called Waialua Bay on the northwest is hardly more than an open roadstead.

More coral is found about Oahu than about the other islands.

Along the windward and lee shores of the island there are extensive growing coral reefs, and a large portion of the narrow coastal plain which surrounds the island, with the exception of the Kaena Point and Makapuu Point regions, is composed of uplifted coral reefs. Honolulu is built on one of these uplifted reefs.

At one time the island of Oahu was deeply submerged (800 or 700 feet) and then uplifted (150 or 300 feet). The coral reefs were built while the island was depressed, the subsequent elevation bringing them to the surface.

The fact that the island of Oahu has been depressed helps us to explain some of its features; thus Kaneohe Bay is a sunken region; the deep Kahana inlet was the mouth of the valley at one time; Pearl Lochs may be submerged valleys, though undoubtedly the immense amount of fresh water which escapes beneath the surface in this region helped keep the passageways open by preventing the building of the coral, and so played an important part in the formation of the Lochs.

Honolulu Harbor was formed by the coral reef which extended across the entrance, an opening being left in the reef for the escape of the fresh water of the Nuuanu and adjoining streams; this channel has been deepened by dredging, and now forms the passageway at the entrance of the harbor. The coral has also built across the entrance to Kaneohe Bay; through the reef there are two narrow but deep openings which vessels can enter. The interior of the bay is filled with coral, and is navigable only for small-sized craft.

There are a number of small islands across the entrance to Kaneohe Bay, some of them just visible; these islands are undoubtedly parts of eroded ridges which were depressed, leaving but the summits exposed above water. Mokolii near Kualoa Point is the largest of these islands. The islands off Waimanalo are of a similar formation.

Pearl Lochs. —Pearl Harbor consists of two bodies of water, known as East and West Lochs, which are separated by a long, low peninsula. The East Loch is the larger of these two divi-

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KAUAI

sions, including the greater part of the harbor. A long, narrow passageway connects with the sea, almost landlocking the harbor. The bar at the entrance of this passageway has been dredged to float the largest of battle ships.

The Pearl Lochs require only a little dredging to make them one of the finest and safest harbors in the Pacific.

Mountains. — The island of Oahu consists of two parallel ranges of mountains: the Koolau range extending along the eastern side, and the Waianae range along the southwestern side. At one time these two ranges constituted what were separate islands, the space between them having been filled by lava flows from the Koolau range, and finally by wash from both ranges.

Both of these ranges have been denuded by cattle of forest trees, except on the higher slopes. However, the upper slopes have now been made forest reserves and are being reforested.

Waianae Range. — The Waianae range is much older than the other; it is probably as old as Waialeale of Kauai. The highest point of Oahu is in this range — Kaala, 4030 feet above sea level.

Originally this range was much higher than it is at present, and probably consisted of a single dome which had very much the exterior appearance of Haleakala; but it has been washed down and cut up by erosion until now only the skeleton of the former mountain remains.

The range is broken midway by the Waianae gap, through which a trail passes to the site of the Waianae Plantation. At Waianae the ridges separating the gulches have been almost entirely worn away by erosion, leaving a part standing near the sea as an isolated peak. "The Sphinx of the Pacific" from which Hitchcock made his noted painting is such a peak. Back of Waianae are cliffs similar to those found on the windward side of the Koolau range.

At first sight it would appear that while the erosion on the southwest slopes of this range has been very extensive, comparatively little has taken place on the northeast; but later obser-

vation will show that there has been fully as much on this side, but that the valleys and ridges so formed have been buried out of sight beneath the lava flows from the Koolau range, and later by wash from that range.

The Koolau Range. — The Koolau Mountains of Oahu are the longest of our island ranges, extending from Makapuu Point to Kahuku, a distance of 37 miles. The southern end of the range terminates abruptly in Makapuu Point, the base of which is washed by the sea, but the northern end spreads out in several ridges that terminate in cliffs overlooking the lowlands between Kahuku and Waimea Valley. Konahuanui, 3105 feet high, and Lanihuli, 2775 feet high, are the highest peaks of this range.

The range is broken by three gaps of erosion, at the head of the Nuuanu, Kalihi, and Kaukonahua[1] gulches. At the Nuuanu gap (the Pali), a fine macadamized road has been built, connecting Honolulu with the Koolau side of the island. The trails in the Kalihi and Kaukonahua gaps are seldom used now, though in ancient times they were frequently traveled by the natives in passing from one side of the island to the other.

As the Koolau range is stretched directly across the course of the trade wind, there has been a very heavy rainfall on the windward side of the island, and consequently great erosion. So great has the erosion been that the ridges dividing the different valleys are hardly visible in many places, leaving an unbroken stretch of pali from 1000 to 2000 feet high. Such is the case back of Kailua and Kaneohe. The formation is so unusual here that it has been often accounted for by the theory that this part of the island was once a crater, the northeast rim of which slid off into the sea. Undoubtedly, if this island has been depressed, the action of the sea waves helped wear away the ridges; but the contour of the land here is no doubt chiefly the result of rain erosion.

The scenery on the windward side of this range is very grand, being somewhat similar to that on the north of Kauai.

[1] The Kaukonahua gulch is the one that leads up from Wahiawa.

The lee side of the Koolau range may be divided into two parts — that which is protected by the Waianae range, and that portion lying back of Honolulu which is exposed to the Kona storms; the former is not cut up by erosion to any extent, but the latter by many deep gulches, such as Kalihi, Nuuanu, and Manoa. These gulches are all fine examples of erosion, the streams having worn their way back to the core of the mountain; at Nuuanu the back ridge has been cut through, forming the gap at the Pali.

THE "PALI."

The plain between the mountain ranges is 800 feet high at its highest point, near the Leilehua Cattle Ranch. The water north of the divide flows to Waialua and that south to Pearl Harbor. So the streams from both slopes of the mountain turn at right angles, flowing either towards Waialua or Pearl Harbor. The plain presents an almost unbroken stretch, and with water would make one of the most productive parts of our Territory. The slopes of this plain on both sides are planted with sugar cane.

Tufa Cones. — Near Honolulu there are a number of tufa cones which not only play an important part in the general topography of the country, but are of historic interest as well. The most important of these are: Koko Head, Diamond Head, Punchbowl, and the Salt Lake Crater (Aliapaakai). These cones are composed of cinders and tufa; the eruptions which formed them were probably of very short duration, lasting but an hour or so.

Diamond Head is a marked and picturesque feature of the landscape. The rim of this crater is a complete circle; the highest point is on the south side. The rim has been broken down in one or two places, and both slopes of the south wall have been cut up by a number of small ravines, possessing all the qualities of the range back of them. Animals enter the crater freely, and it is used as a pasture. During the rainy season there is a pond of water in the bowl.

Punchbowl (just back of Honolulu) is much older than Diamond Head, its crater being almost entirely filled with débris washed from the sides. The material thrown from this cone covers a large part of the surface of the site upon which Honolulu stands. Punchbowl was the site of a battery of cannon placed there by Kamehameha I. to defend the town. These guns have now been removed.

The Salt Lake Crater (east of Pearl Harbor) is a twin cone; in the bowl of the larger cone there is a salt lake which is supposed to be connected with the sea. During dry times a thick crust of salt forms on the surface of this lake. The other cone contained a fresh-water pond, but this has been drained away and the bowl planted with sugar cane.

In the Tantalus series of cones (just back of Honolulu), upon which there are now a number of suburban residences, there are many tufa cones. The peculiar black sand which is so commonly found about the city came from these cones.

Drainage. — Owing to the nature and arrangement of its mountain ranges, Oahu is not supplied with as many or as large running streams of water as are found on the other islands.

Except in times of southerly storms, the rainfall on the Waianae range is not great, as the wind is first intercepted by the Koolau range; so that there are but a few small streams on this part of the island. Owing to the short, abrupt slope on the windward side of the Koolau range and the long broken line of sharp peaks at the summit, very little of the heavy rainfall is conserved, but immediately finds its way to lower levels; thus on both sides of this range there is an abundance of water which appears at sea level in the form of springs, or underground streams.

The fact that there was much fresh water escaping along the seashore finally led to the experiment of sinking artesian wells. In 1879 a small flow was secured from a drill sunk at Honouliuli near the Ewa Mill. The following year two wells were sunk near Oahu College in the outskirts of Honolulu, one of which (Ontario Well) yielded a strong flow of water. There was great excitement when the water first gushed from these borings. Other wells were immediately sunk about the city and on different parts of the island, so that now there are between 200 and 300 in all; only a part of these, however, are flowing wells, the water being pumped from the greater number of them.

The discovery of this artesian water has added greatly to the prosperity of the island. A great stimulus was immediately given to the rice industry; and the establishment of the extensive sugar plantations along the dry and barren coastal plain of Oahu was made possible. Since the first artesian well was sunk, Honolulu has grown rapidly, for previous to that time the water supply was quite insufficient.

After a number of wells had been sunk, a noted engineer predicted that the supply of water would be exhausted in a year or two. This led to the passing of a statute by the legislature, making it obligatory that all flowing wells be capped.

This artesian water is found in a porous layer of rock (vesicular lava) between two clay strata. The water rises in the boring through the pressure of the incoming sea water, — in Honolulu it does not rise higher than 42 feet above sea level. These flowing wells are peculiar to the islands of Oahu and Kauai,

which has a few wells at Kealia; for there are no flowing wells elsewhere on the group.

Industries. — The sugar estates of Oahu comprise some of the most extensive in the group. They number seven.[1] As all of these plantations depend largely upon artesian wells for their water supply, very little cane is flumed, but it is carried to the mills by a system of permanent and portable tracks.

WAIPAHU SUGAR MILL.

The Ewa Plantation occupies the low, flat lands on the west side of Pearl Lochs and above Barber's Point, which is an elevated coral reef covered by wash from the highlands. The soil here is particularly well adapted for cane growing, the average yield per acre being greater than that of any other plantation on the islands. The entire water supply is pumped from artesian wells.

Formerly there was a small plantation at Waialua which was

[1] See Appendix A for list of plantations.

irrigated by water from the streams; but a new company was organized which developed water by sinking artesian wells, and by the construction of a huge dam across the junction of the north and south forks of the Kaukonahua gulch at Wahiawa. When the dam is filled, the water backs up in the two forks of the gulch, forming a lake which extends four miles inland. The water is carried by a system of ditches and tunnels to the upper lands of the plantation. This plantation occupies all of the low lands about Waialua, stretching as far up on the highlands as the water supply will admit. It is destined to become one of the most important sugar producers of the group.

Artesian wells furnish water for the lowlands at Waipahu (Oahu Sugar Company) and Aiea (Honolulu Plantation); the lands on the upper slopes being irrigated from mountain streams, except during dry weather, when it is sometimes necessary to pump water even upon these lands.

The Waianae Plantation occupies two of the broad valleys on the lee side of the Waianae range.

Kahuku is on the north end of Oahu; the cane planted at the Mormon settlement at Laie is ground here.

The Waimanalo Plantation is a small one occupying a flat near the southwest end of the island.

Rice Fields at Moanalua. Koolau Range in Background.

On the lowlands about Honolulu and Pearl Lochs a great deal of rice is grown. On the windward side of the island it is the chief industry, the narrow coastal plain of Koolauloa and Koolaupoko being occupied by an almost unbroken stretch of rice fields.

Parts of Oahu are well adapted to pineapple growing. Pineapples are planted extensively at Wahiawa, on the lands above Pearl City, and on the homesteads at Pupukea and Paumalu, between Waimea and Kahuku. Some of the fruit is canned on the field, but the greater part is sent by rail to the Hawaiian Fruit Company's cannery in Honolulu, where it is prepared for market.

Sisal is grown extensively near the Ewa Plantation, where there is a mill which prepares the fiber for the market.

Besides transporting the sugar from the various plantations to Honolulu, the railroad which nearly girds Oahu, with its branch road extending from Waipahu to Wahiawa, gives an impetus to a number of small industries in different parts of the island by affording ready means of transportation to a market.

The lands of Oahu not utilized for agriculture are devoted to cattle raising. There are a number of small ranches on different parts of the island.

Fish Ponds. — Owing to the shallowness of the water along the shore and the number of protected bays and sheltered coves, there are a great number of fish ponds about the island of Oahu. These are most extensive along the Koolauloa, Koolaupoko, and Honolulu shores. Most of the fish ponds were built in ancient times; in some cases a wall was built across the entrance to a small bay, but more often semicircular walls were made inclosing a portion of sea water. The walls were loosely constructed of stones to allow free access to the sea water, and were provided with gates so that the fish could be driven into the ponds.

This industry has almost entirely passed into the hands of Chinamen, who have repaired the walls of disused ponds and carry on the industry as they were taught by the Hawaiians. Mullet (ama-ama) are chiefly raised in these ponds, though awa and other small fish breed there also. When a part of the fish are large enough, they are caught in nets. After this the ponds are allowed to rest for a while, when the fish are again caught.

At Kailua there is an extensive inland pond, and also near Honolulu there are similar smaller ponds, where fresh-water mullet are raised.

Districts. — The districts of Oahu are Honolulu, Ewa and Waianae, Waialua, Koolauloa, and Koolaupoko.

The district of Honolulu is a small one, but it contains about one fourth of the population of the whole group. Ewa and Waianae comprise more than a third of the island; and, with the Honolulu district, constitute the most important section of the group. Koolauloa and Koolaupoko occupy the entire windward side of the island.

Honolulu. — Honolulu, the capital city of the Territory, is a town of about 40,000 inhabitants. It is situated on a small,

City of Honolulu.

well-protected bay on the south side of Oahu. The harbor has been enlarged by dredging, so that it can now accommodate a large fleet of vessels, and float the largest of ocean-going steamers. The Oahu Railway and Land Company's slips occupy the western side of the harbor, and the Marine Railway Dry Dock and Naval Wharves the opposite side.

The wholesale business houses are located near the wharves, below the intersection of King and Fort streets. From this point the city stretches along the coastal plain five or six miles, extending well up into the valleys back of the town.

Honolulu is the commercial center of the group, being connected by railway with all parts of Oahu, and by a frequent steamer service with the other islands of the group. Nearly all of the Trans-Pacific lines of steamships make this a port of call.

YOUNG HOTEL, HONOLULU.

The town is well laid out in parks, has a good water and sewer system, a well-equipped fire department, a fine electric car service to all parts of the city, and is lighted with electricity and gas. Besides a number of excellent business blocks, there are some fine public buildings and churches. In addition to an excellent public school system, there are a number of good denominational schools. There are a number of points of interest about the town, as Waikiki, Nuuanu Valley and the Pali, Diamond Head, Punchbowl, Tantalus, Moanalua, The Aquarium at Waikiki, and the Bishop Museum.

Waikiki is a suburb of Honolulu, situated along the shore extending from Diamond Head towards town. There are a number of bathing resorts here, and a fine beach. Kapiolani Park is located at Waikiki.

The Pali commands a splendid panoramic view of the opposite side of the island. It is in the Nuuanu Valley, where Kamehameha by his victory over Kalanikupule finally made himself master of the group. It is said that the remnant of the defeated army were brought to bay at a point near the Pali, and that

here they leaped to death rather than suffer the tortures of capture.

Moanalua is a beautiful country residence, the park-like grounds of which are open to the public.

At the Kamehameha Schools is the Bishop Museum. The chief feature of this museum is its Hawaiian collection, but it also includes the world's finest collection of Polynesian relics

HAWAIIAN HOTEL.

and antiquities. There is also a fine Hawaiian and Polynesian ethnological collection in the museum.

Just beyond the limits of the town near Moanalua is the United States Military Camp, Fort Shafter.

Other Towns. — Aiea, Waipahu, and Ewa Mill are plantation settlements. The so-called Pearl City is a small settlement on the railroad at which is located the public cemetery. A branch road extends from Pearl City to the Peninsula, where there are a number of suburban residences. Waianae is the only town of importance on the west side of the island. At Waialua there

is a large settlement, though it is somewhat scattered; a fine hotel is located here on the sea beach. Laie is a Mormon settlement; there are a Mormon school and church here. Hauula, Waikane, and Kaneohe are the chief places on the windward side of the island.

At Waialee, near Kahuku, is the Boys' Industrial School, which is a model institution of its kind.

Not far from the Ewa Mill, below Sisal, is the United States Magnetic Station.

156° 0'
155° 40'
Longitude
155° 20'
West
20° 0'
19° 40'
19° 20'
19° 0'
Upolu Pt
Honoipu
Mahukona
Puu Hue
Kawaihae Bay
Kawaihae
Waimea
(Kamuela) P O
Alt 2670
Puako
Kohala
Mts
KOHALA
5480
Waimanu
Waipio
Kukuihaele
Kapulehu
HONOKAA
Paauhau
Kalaoa
Koholalele
Papaaloa
Ookala
Laupa
Kaanakolu
MAUNA KEA
13823
Kihola
Makalawena
Puu Waawaa
Huehue
Keahole Pt
HUALALAI
8269
Kaiwi Pt
Kailua Bay
Kailua
HOLUALOA
Kahaluu
Keauhou
Kainaliu
Kaawaloa
Napoopoo
Kealakekua Bay
MAUNA LOA
13675
Honaunau
Hookena
Pahoehoe
Puu Kalepeamoa
Hoopuloa
Papa
Milolii
Honomalino
Okoe
Kapua
Puu o Keokeo
Mohokea
Pahala
Punaluu
Honuapo
Kaalualu
Waiahuiu
Na Puu a Pele
Puu Ki
South Point
(Ka Lae)
MOKUAWEOWEO
Crater
Kilauea
Crater
Ainapo
Kaumana
Waiakea
Hilo

HAWAII

Physical Features. — Hawaii is at the extreme southeastern end of the group. This island, which is 4015 square miles in extent, includes about five eighths of the area of the whole group. It is a little smaller than Connecticut, and larger than Porto Rico by 680 square miles.

Roughly speaking, Hawaii is a triangle, the chief capes — Upolu Point, Kumukahi Point, and South Point (Ka Lae) — being at the angles. On the windward side there are high cliffs; near the Waipio and Waimanu valleys these cliffs are several thousand feet high. Hilo, Kealakekua, Kailua, and Kawaihae are the chief bays of Hawaii. These bays were formed by lava flows which have pushed their way out into the sea on one or both sides. None of the bays have protecting coral reefs such as are found on the other islands. The reef in the Hilo Bay is a submerged lava flow; Cocoanut Island is a portion of the same flow.

As Hawaii is a new island, there is comparatively little coral found about it; and its beaches are mostly of black sand, or white and black sand mixed.

The island of Hawaii consists of the mountain masses of the Kohala range, Mauna Kea, Hualalai, and Mauna Loa. The sea has eaten its

way deeply into the slopes of the Kohala Mountains and Mauna Kea on the windward side, forming a long line of cliffs several thousand feet high in places, but no inroads to speak of have been made on the Hualalai and Mauna Loa slopes on the opposite side. The spaces between the mountains were water ways, no doubt, at one time, but these were filled by lava flows, and are now plateaus.

Kohala Mountains. — The Kohala range is the oldest of Hawaii's mountains, being as old as West Maui and Waianae

NORTHEAST COAST, HAWAII.

of Oahu. We judge this to be so from the amount of erosion which has taken place. The highest point of this range, which seems to consist chiefly of a collection of cinder cones, is 5489 feet above sea level.

The Waipio and Waimanu region is a part of this range. The remarkable gulches and stupendous sea cliffs which are found here may not be wholly the work of erosion, but perhaps partly the result of a great fault which caused a section of the coast here to break off into the sea.

WAIPIO VALLEY AND HIILAWE FALL.

The summit of the Kohala Mountains, which is said to consist of a peat bog, is heavily wooded, as are also the windward slopes.

The Waipio Valley is the largest of the Hawaiian gulches. It is not a pretty one, however, with the exception of the spot where the beautiful Hiilawe fall takes its plunge of 1700 feet. But there is no Hiilawe now, except in very rainy times, for the Kukuihaele Plantation has taken the water for fluming cane. This gulch runs back for three or four miles and then turns at right angles, running past the head of the Waimanu Valley.

Waimanu is deeper than Waipio, but is not so wide. This gulch is chiefly remarkable for the amazing semicircular pali at its head, with its numerous waterfalls. The Waimanu is a short gulch, extending only four miles back to the ridge that separates it from the Waipio Valley.

There is a trail from Waipio to Waimanu which crosses twelve ravines in the distance between the two great gulches. In rainy weather this path is not a safe one to travel on horse-

HA
KOHALA
HAMAKUA
MAUNA KEA
HILO
HUALALAI
KONA
MAUNA LOA
KAU DESERT

back. Both of these gulches contain wide flood plains, having a gentle slope inland from sea level. In their lower sections the valley bottoms are entirely planted with rice.

Mauna Kea. — Mauna Kea occupies more than half of the northern part of Hawaii, nearly the whole of the South Kohala, Hamakua, and Hilo districts being on its slopes. It is the highest island mountain of the world, being 13,825 feet high.

Mauna Kea does not end in a peak, but has a summit platform about five miles long and two miles wide. Upon this platform there are a dozen or more huge cinder cones. A great number of these cinder cones are also found about the upper part of the mountain, — they are Mauna Kea's striking feature.

The north and east sides of Mauna Kea have a heavy rainfall, the lower slopes of Hilo and Hamakua being cut up by many gulches. These gulches are of a good size, but do not compare with those of West Maui, Oahu, and Kauai, for they hardly extend to the base of the summit dome, while the great valleys on the other islands have eaten their way into the very heart of the mountain. The upper part of the windward slope has not suffered much from erosion yet, while the opposite side shows scarcely any weathering at all. The lower slopes are heavily wooded on the windward side (north and east), but on the opposite side they are quite bare.

During winter storms this mountain, as well as Mauna Loa, is heavily covered with snow — the snow reaching more than halfway to the forest line at times.

On the south side of Mauna Kea's platform, 12,000 feet above sea level, is the ancient

quarry of Keanakakoi, where the natives made their stone adzes. Also, among the cinder cones on the summit is Lake Waiau — a small lake of a few acres in extent, and having a depth of 40 feet, which is fed from the melting snows.

Summit of Mauna Kea.

Hualalai. — Hualalai is a much smaller mountain than Mauna Kea, but otherwise it is very similar. Like Mauna Kea, Hualalai has no crater on its summit. Probably the craters on both of these mountains were filled with lava and then buried out of sight beneath the sand and fragments thrown from the cones on their summits. Hualalai is 8269 feet high.

The mountain is almost entirely within the district of Kona. Near the sea the slope is gradual, but above this it is abrupt. The north side of the mountain is bare, but the other sides are wooded, though not heavily. There are no gulches whatever on the slopes of this mountain.

The last flow from Hualalai was in 1801. This flow broke out low down on the mountain not many miles north of Kailua. Kamehameha visited it and threw a lock of his hair into the flowing lava to appease the wrath of Pele.

Mauna Loa. — Mauna Loa covers the whole southern half of Hawaii and a part of the Hamakua and Hilo districts. Here we find the forces which have made our islands, still at work in the volcanoes of Kilauea and Mokuaweoweo.

Trail to Summit of Mauna Loa.

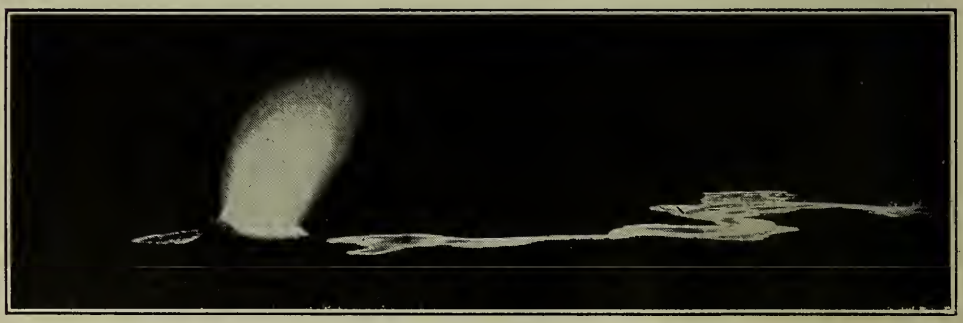
Mauna Kea can be ascended easily on any side, but not so Mauna Loa; for on every side there are wide regions of the roughest of lava flows extending from near the summit to the seashore. Where there is rain, these flows are covered with heavy forests, and are fast being converted into soil, but in the rainless regions they are as bare and rugged as when they first came down.

The cones found on Mauna Loa mark the spot where outbreaks of lava occurred. The slope on the upper part of the mountain is much less abrupt than that on Mauna Kea. Like Mauna Kea, it, too, has the summit platform. Sunk in this platform is its crater, Mokuaweoweo — the second largest active volcano in the world.

Mokuaweoweo is not always active, but is so only at times.

When it is active, there is a lake of lava in the lower part of the crater, with playing fountains, presenting a magnificent spectacle at night from the brink. This activity usually lasts a few days and then the lava forces its way through the side of the mountain, making a lava flow. When the lava thus finds an outlet lower down, the eruption in the crater ceases.

ERUPTION IN MOKUAWEOWEO CRATER, 1903.



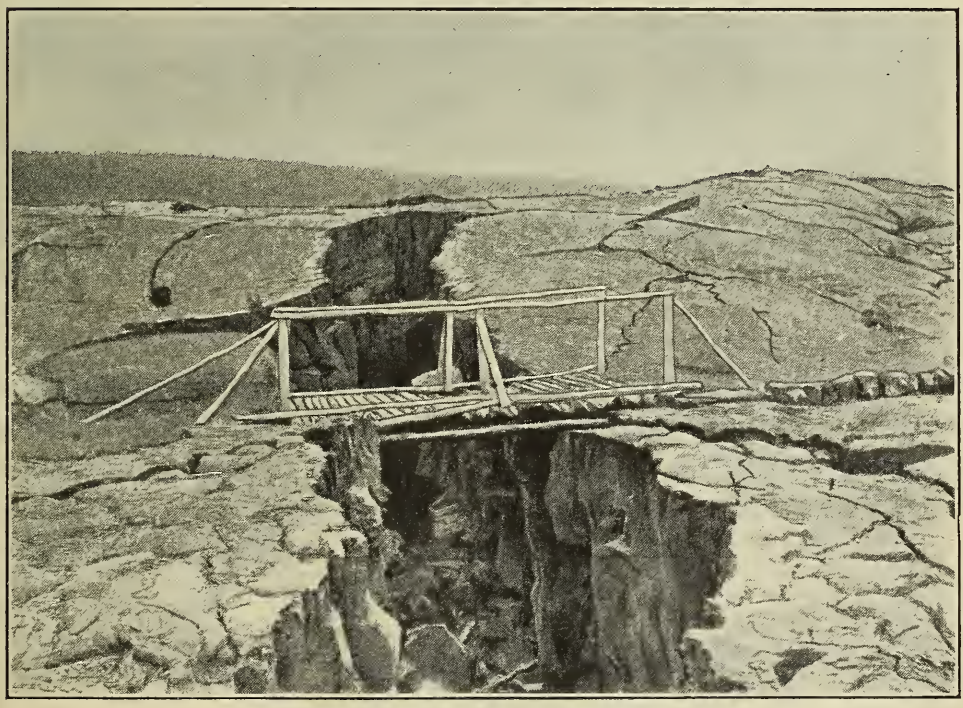
NIGHT VIEW OF ERUPTION IN CRATER.

Mauna Loa is 13,675 feet high, its platform being higher than that of Mauna Kea; it is the cinder cones of this latter mountain which carry it 150 feet higher than Mauna Loa. The crater of Mokuaweoweo is $3\frac{3}{4}$ miles long and $1\frac{3}{4}$ miles wide; it is inclosed by walls from 500 to 1000 feet high.

Kilauea.[1] — Kilauea is on the northeastern slope of Mauna Loa, 4000 feet above the sea. It is the largest active volcano in

[1] "Crater of Kilauea," Charles W. Baldwin, *Hawaii's Young People*, November, 1900.

LAVA CASCADE IN CRATER OF KILAUEA.



CREVICE IN FLOOR OF CRATER.

the world. The crater is a huge, lava-covered pit. This pit rises towards a spot near the south side, giving it, as seen from the Volcano House, the appearance of being nearly filled. At one time the crater was much deeper than it is now, containing a pit within a pit. But the lava has buried the lower pit out of sight and is gradually filling the other. Formerly a lake of lava was always to be found in the crater of Kilauea, but of late this

VOLCANO HOUSE.

lake has disappeared at times. At such times there is a huge pit where the lake was, from which a dense cloud of sulphurous smoke is constantly rising, and spots about the pit are very hot — too hot to stand on.

The crater of Kilauea will always be an object of great interest, and well worth a visit, even when no fire is to be seen there.

Some points of interest about the crater are the sulphur banks; the koa forest; Kilauea Iki, a deep pit crater; and the pit craters near the Puna trail.

Kilauea is three miles in length and two miles wide. The side towards the Volcano House is 500 feet high in places, but the opposite or south side is very low.

Table-lands. — The table-land between the Kohala Mountains and Mauna Kea is from 2500 to 3000 feet high. This is a grass-covered plateau, affording excellent pasturage for the large herds of the Parker Ranch Company.

The plateau between Mauna Kea and Mauna Loa is from 5000 to 6000 feet high. In contrast to the other one this is but a tangled mass of lava flows of the roughest kind. A large number of the more recent flows from Mauna Loa have passed over this region — flowing to the sea between Puako and Kiholo, or towards Hilo. As the greater part of the plateau is in the rainless region between the two mountains, even the oldest of the lava flows have changed but little. The Humuula Sheep Station uses a portion of the region as a sheep pasture, but the larger part of the plateau must remain forever a useless waste of lava.

Lava Flows.[1] — A striking feature of Hawaii is its lava-covered regions and lava flows. In the rainless sections a great many of the flows look very new, but no one knows when they occurred. Within the last hundred years there have been eleven great flows; nine from Mauna Loa, one from Hualalai, and one from Kilauea.

Five of the flows broke from a spot on Mauna Loa's northeastern slope, 11,000 feet high. Three of the flows (1852, 1855, and 1881) which broke from this spot seriously threatened the town of Hilo; one of them, the 1881 flow, coming within three-quarters of a mile of Waiakea, and the 1855 flow seven miles from the town, when, for some unknown reason, it began spreading and banking, which it continued to do for thirteen months.

Three of the flows (1868, 1887, and 1907) broke out on the southern slope, and one (1859), on the northwestern slope of the mountain, flowing around Hualalai into the sea at Kiholo.

[1] "Lava Flows of Hawaii," Charles W. Baldwin, *Hawaii's Young People.*

Trail over Lava Field.

The flow of 1840 from Kilauea forced its way along just below the surface, finally breaking out and flowing eight miles to the sea in Puna. The flows from Kilauea have usually occurred in this manner. They have flowed chiefly over Puna.

Usually these lava flows have broken out very quietly, a bright light upon the mountain side being the only indication that an eruption was in progress. The 1868 eruption was an exception, for a week before this outbreak occurred the Kau district was shaken by the most fearful earthquakes. The lava finally forced its way out through a long rent in the mountain side two miles above the present Kahuku Ranch houses, pouring out an overwhelming flood, which soon reached the sea.

During one of the heaviest of the 1868 earthquakes a water-soaked pali near the Kapapala Ranch in Kau was torn off and hurled down over the land a distance of three or four miles, overwhelming a native village. This is known as the "Mud Flow"; thirty lives were lost in it. (The Mud Flow is now planted with sugar cane, the best cane grown on the Pahala Plantation being on the flow.)

This same earthquake caused a disastrous tidal wave to sweep the Puna and Kau coasts, destroying the village of Honuapo and drowning a number of people. It also opened a deep fissure (1868 Crack), eighteen miles in length, through the lower end of which, at a point above the sea between Punaluu and the old Keauhou landing, the lake of lava in the crater of Kilauea emptied itself, forming a pahoehoe flow.

It is not known that any lives have been lost in the lava flows of Hawaii. These flows have passed over waste regions, with the exception of those of 1868 and 1887, which destroyed the best of the Kahuku pastures.

Mokuaweoweo was usually active a few days before one of these outbreaks occurred, the activity in the crater ceasing when the lava forced its way out lower down. The lava pouring out in a great fountain of fire, and the fiery stream hurrying off down the mountain side, presented a spectacle seldom equaled for grandeur.

Climate.—Owing to the height and position of its mountains, Hawaii has a greater variety of climate than the other islands of the group.

Usually the trade wind reaches nearly all parts of our islands by blowing over and around them, but the mountains of Hawaii are too high and large, hence the whole western side of the island, which includes the larger part of South Kohala and both the Konas, is entirely free from this wind.

That portion of the island sheltered from the trade wind is generally dry, but Kona is an exception to the rule. There is a dry belt near the sea, a mile or so wide, but above this the rainfall is abundant. The mountain slope, a short distance back from the shore, is abrupt, hence the sea breeze is turned upwards, meeting the colder air above before it has had a chance to lose its moisture, and rain is the result. Kona's rainy season is during the summer months, and its dry season in the winter.

The region extending from Kalapana in Puna on one side to Papaaloa in Hilo on the other is directly exposed to the trades, yet this wind is seldom felt here. This is due to the position of

the mountains back of this part of the island, which check the wind, turning it upward and to one side. The moisture-laden wind thus turned upwards meets the cold air above, and causes the heavy rainfall of this region. The town of Hilo, which is near the center of this tract, has been well named the "Rainy City," having as great a rainfall as almost any place in the world. Owing to the heavy rainfall the Hilo and Puna districts are covered with dense forests.

The rainless regions of Hawaii are the plateau between Mauna Loa and Mauna Kea, a wide district from Kawaihae to Kiholo, and a belt of land near the sea extending through Kona, Kau, and into southern Puna. This dry belt is very narrow in Kona, but widens before South Point is reached in Kau.

The larger part of this rainless tract is covered with lava flows which appear quite fresh, though they may be hundreds of years old. The regions from Puako to Kiholo, Hoopuloa to South Point, and between Punaluu and Kalapana are very interesting, being covered by the newest of the flows. There is a trail over the lava from Puako to Kiholo which is often traveled, but the two latter sections are never crossed.

Vegetation. — With the exception of the section between Hualalai on the south and the Kohala Mountains on the north, Hawaii is encircled with a wide forest belt. On the windward side this forest belt formerly extended to the cliffs along the coast. The finest and most impenetrable forests of the group are those found in the Hilo and Puna districts.

These forests do not differ in make-up from those on the other islands, except that there are groves of young sandalwood trees found in parts of Kona and Kau, and in the Olaa jungles there are a great many loulu palms. (These latter are a species of fan palm, from the undeveloped leaves of which the finest Hawaiian hats are made.)

The forest belt extends as high as 6000 and 7000 feet; above this there are shrubs and a species of long grass which grow up to an elevation of 11,000 feet; still higher the mountain is bare of plant life.

The North Kohala section of the island has been denuded of forest trees by fire and cattle to such a degree that the watersheds have been affected, causing springs to dry up and the rainfall to decrease.

Industries.—Hawaii has twenty-five sugar plantations,[1] and produces one third of the whole amount of sugar produced in the group. Most of the sugar comes from the windward side of the island, where cane is grown without irrigation. From Olaa to Waipio is an almost continuous belt of sugar cane, broken only by the gulches.

Forest in Olaa.

Nearly all of the coffee grown on the Hawaiian Islands comes from the Hamakua and Kona districts.

The Waipio, Waimanu, and Pololu valleys are the only places on Hawaii where rice is raised. This rice is packed to the landing on the backs of mules.

Parts of Hawaii are well adapted to the growing of fruits, and no doubt a great many such would be raised by the homesteaders and small farmers, were it not for the difficulty of getting them to market.

[1] See Appendix A for list of plantations.

Heiau (Ancient Temple) at Kawaihae.

Entrance to Heiau.

Dry-land taro is chiefly raised on Hawaii. This is planted among the forest trees, requiring only to be weeded a few times to produce a good crop.

Cattle raising is an important industry on Hawaii, large tracts in various parts of the island being used for that purpose. Most of these places would not be fit for anything else, as they are rough, lava-covered regions, but the finest of cattle are raised on them.

In parts of South Kona and Puna the chief industry is fishing, the fish being dried and sent to the Honolulu market.

Districts. — The districts of Hawaii are Kohala (divided into North and South Kohala), Hamakua, Hilo, Puna, Kau, and Kona (divided into North and South Kona).

South Kohala. — South Kohala is almost entirely within one of the dry regions, hence is not of much importance. There is a small plantation at Puako, the cane being irrigated by means of pumps. The wireless station is located at Puako. The Parker Ranch, one of the largest cattle ranches on the islands, is chiefly within this district. Kawaihae and Waimea are the principal places. The Hamakua passengers and mail are landed at Kawaihae. A great many cattle, also, are shipped here. Formerly there was scarcely a shrub to be found at Kawaihae, but the village is now enveloped in algaroba trees.

On a hill overlooking the bay and village of Kawaihae is the heiau of Puukohola, built by Kamehameha in the year 1791. This was one of the largest and most recent of the heiaus built. It is very well preserved, the inclosing walls being almost perfect. The heiau was built as a favor to the gods to secure to Kamehameha the kingdom of Hawaii, and so was undoubtedly the incentive which led the impatient conqueror to the treacherous murder of the brave Keoua as he leaped ashore on the sands almost within its shadow.

North Kohala. — For many years the growing crops in Kohala were dependent upon the rainfall for their water supply, but a ditch was recently constructed into the Kohala Mountains, and now all of the plantations irrigate their cane. This ditch is

owned by the Kohala Ditch Company, the water being leased to the planters.

The Kohala ditch is twenty-five miles in length, extending from Wailoa, which is not far from the head of the great Waipio gulch, to the lands above Honoipu. The construction of this ditch was a great undertaking, for it traverses a rugged and

STATUE OF KAMEHAMEHA IN KOHALA.

broken country. Sixteen miles of the ditch consists of tunnels. The scenery along the ditch line is some of the finest in the group.

Hawi, whose cane fields extend well around toward Honoipu, is the chief plantation of the district, being as large as the others combined.

The sugar is sent by railroad to Mahukona, except that from Hawi, which is shipped from Honoipu. Mahukona and Honoipu are the only landings for Kohala now, the others having been long ago abandoned. Sugar is shipped directly to San Francisco from both of these places.

Kohala usually means that part of the district occupied by the plantations. Kapaau is the central place of this part of the district, and contains the post office and the courthouse. There are settlements at each of the mills.

Kohala has a larger percentage of white people than is usually found in the out-districts; also there is a large Chinese population. The Kohala Seminary, the girls' industrial school for the island, is located here. At Kapaau is the statue of Kamehameha I. It is said that Kamehameha was born near this spot.

No doubt many changes will take place in this district since the construction of the Kohala ditch, for there are large tracts of land above Honoipu that need only water to make them produce the finest of cane. We should also expect the center of population to shift gradually towards Hawi.

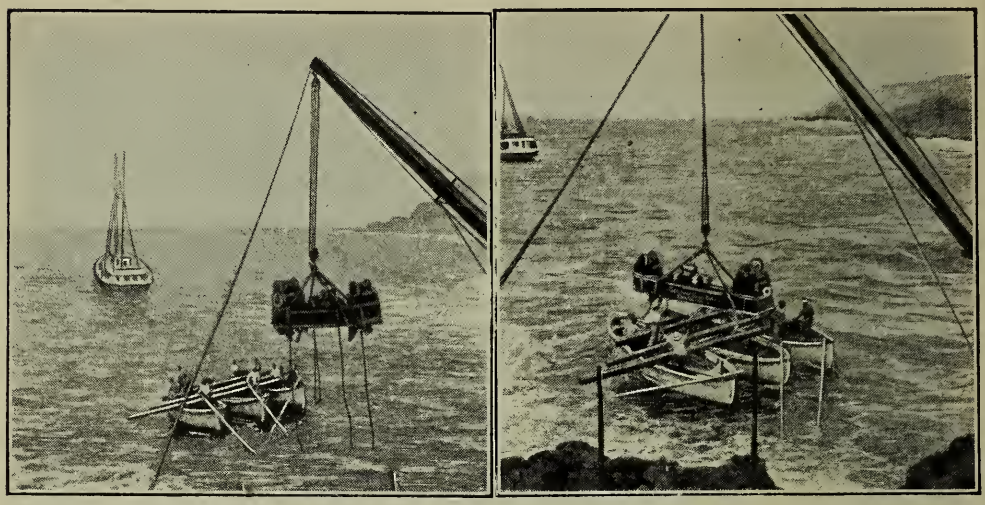
Hamakua. — Outside of the Waipio region Hamakua has no running streams, or even springs. This is due to the abrupt slope of this part of the island, which allows the water to run off readily, and to the fact that the gulches run up towards the Waimea plateau, thus having no good watershed back of them.

Two ditches have been recently constructed, bringing the Waipio water upon the Hamakua lands. The plantations nearest the gulch use this water for irrigating and fluming their cane, and a portion is used for establishing waterworks for the different villages. Thus great changes have been brought about in this district, for, while rain is abundant as a rule, at times there are severe droughts, when water is very scarce.

Owing to the lack of streams of water and to the abrupt slope, the plantations of Hamakua have had great difficulty in finding means for transporting their cane to the mills. Kukaiau has constructed a complete system of trolley cables. The cane is tied up in bundles and fastened to a trolley which is then placed upon the wire, and so it glides swiftly to the mill. Paauilo has accomplished the difficult task of laying a railroad up through its fields. The other plantations of the district have built rail-

roads out on either side of the mill, sending the cane down to these tracks by gravity roads or flumes.

The government road is a mile or more from the shore — the settlements being divided between this road and the mills, which are near the bluffs along the shore.



HONOKAA LANDING, HAMAKUA.

Each mill has its own landing. The sugar is swung out to the boat or vessel by means of a derrick which is operated by a donkey engine. In rough weather these landings cannot be used at all.

Next to Kona Hamakua is the chief coffee district of Hawaii. One of the finest coffee estates of the group is in this district, at Kalopa, above Paauhau — the Louisson Plantation. It is said that the trees of this plantation bear so heavily that when the berries are ripe, it appears as if a red blanket were spread over the field.

The largest place in Hamakua is Honokaa. Paauhau, Paauilo, Waipio, and Kukuihaele are important places as well.

Waipio is connected with Kukuihaele by a steep trail up the east side of the valley. A road was once built around the sea cliffs from Kukuihaele to Waipio, but large sections of this road have been destroyed by landslides, and it is now impassable.

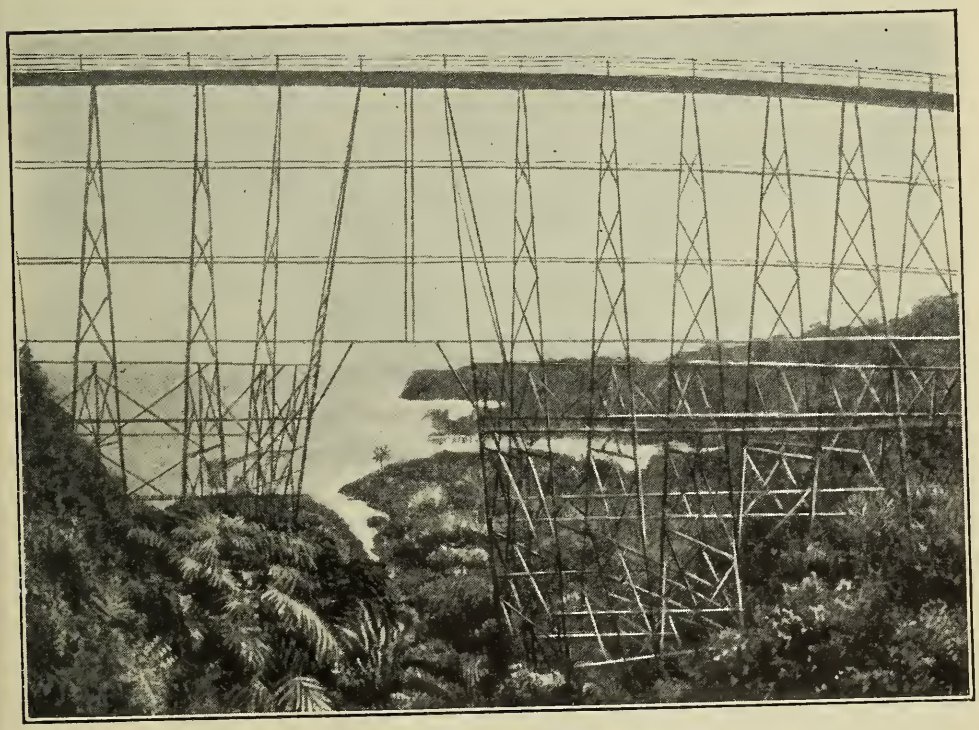
In ancient times Waipio was one of the chief places of Hawaii, having a large population. It was here that Kame-

hameha landed after the sea fight off Waimanu to bury his dead, marching the next day to Waimea, up historic "Mud Lane."

At Ahualoa, above Honokaa, and Kalopa, above Paauhau, are a large number of homesteads.

Hilo. — In contrast to Hamakua, the Hilo district has many deep gulches, each of which has a large, ever-running stream. However, with the exception of the gorge of the Wailuku, which probably began in a lava tunnel, these gulches, though they are large near the sea, do not extend far inland.

This district is one of the most pleasant places of the group, being always green and free from high winds or dust. At night there is a gentle land breeze from Mauna Kea, and during the day the air is kept cool by the sea breeze.



Cane Flume, Hilo.

As water is abundant in the Hilo district, it is used almost entirely for transporting the cane from the fields to the mill. The highest and longest flumes on the islands are found here.

Portable flumes are used for getting the cane to the main flumes which carry it to the mill.

As in Hamakua, each plantation has its own landing; but here the sugar is sent to the vessel on a wire cable which passes from the cliff over the steamer's deck.

PLANTATION LANDING.

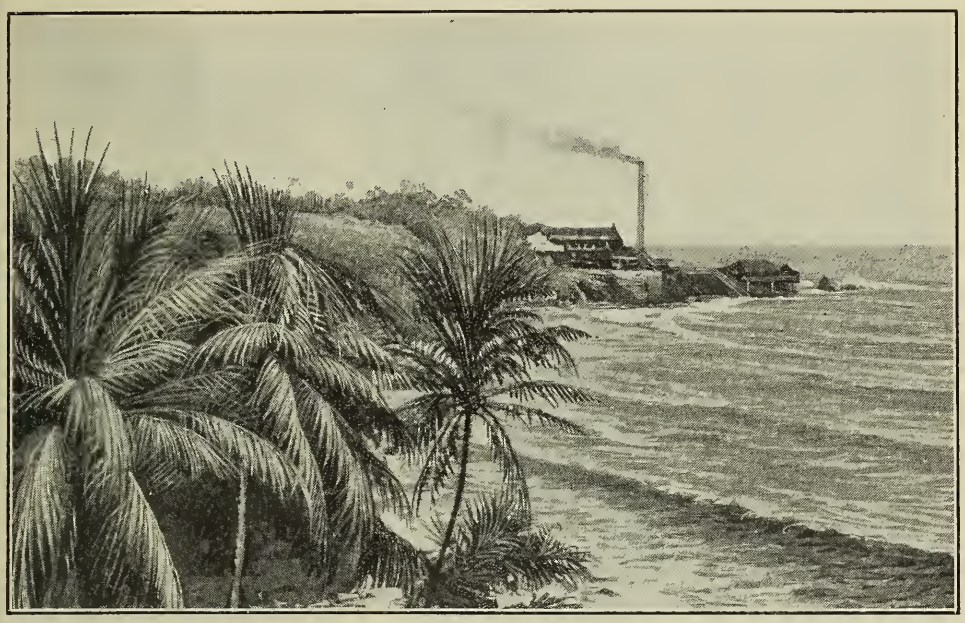
The chief places of the district, named in order from north to south, are Laupahoehoe, Papaaloa, Honomu, Onomea, Papaikou, and Hilo Town. (Waiakea and Wainaku are suburbs of Hilo.)

The town of Hilo is superbly situated, the view from the bay, with the peaks of Mauna Loa and snow-capped Mauna Kea in the distance, making a scene of rare beauty.

Ships can always find a safe anchorage in Hilo Bay, but at times the swell breaks over the reef, and then vessels cannot lie at the wharves. The landing is on the Waiakea side of the bay, where a long pier has been built. The large freighters are loaded by scows towed out from the Waiakea River. (Plans are

now under way for a breakwater, which, when completed, will make this bay a fine harbor.)

Hilo is the distributing center for the Puna and Hilo districts. It is connected with Puna by railroad, and with various points



Sugar Mill in Hilo District (Wainaku).

in Hilo by steamer service. The sugar from the various plantations is sent to Hilo, where it is shipped to the Pacific Coast and New York.

The town is well laid out in streets, and is supplied entirely with electric lights. There is a fine power house where the electricity is developed by water power and furnished at a low cost. There is a high school and well-equipped grammar school, besides large Catholic schools for boys and girls. Also situated at Hilo is the Hilo Boys' Boarding School, from which General Armstrong patterned the famous Hampton Institute in Virginia.

The chief residence part of the town is at Pueo on the north side of the Wailuku River, which is spanned here by two fine bridges.

Points of special interest near Hilo are Cocoanut Island, Rainbow Falls, Onomea Gulch and Arch, the pretty Akaka fall at Honomu, and the Kaumana Caves (lava channels of the 1881 flow); but the whole section about the town, with its enveloping woods and waterfall-studded gulches, abounds in spots of scenic beauty.

AKAKA FALL, 500 FEET HIGH.

The Onomea Sugar Company's Mill is at Papaikou, which is the most important place in the northern section of Hilo district.

Laupahoehoe (see pictures, page 76) is the halfway house between Hilo and Hamakua, and also the landing for mail and passengers for this part of the district. The village stands on a tongue of lava which juts out into the sea from the mouth of the Laupahoehoe gulch. The wharf is in a little cove well protected from the wind, and landing is not difficult, though the sea may be rough outside.

Papaaloa is two miles from Laupahoehoe. The mill here takes the place of the one which used to be near the landing in the gulch.

At Honomu there is a Japanese school with a boarding department. Many Japanese live here in order to send their children to this school. Honomu is one of the prettiest places in this part of the district.

ONOMEA ARCH.

ONOMEA.

LAUPAHOEHOE VILLAGE, HILO.

CLIFF AT LAUPAHOEHOE.

Puna. — There is a tradition which says that at one time Puna was one of the most fertile districts of Hawaii, but while the chief of the district was in Hilo, Pele paid him a visit, pouring over his possessions a terrible flood of lava. However, the rainfall is so great in parts of the district that this lava has been rapidly decomposed, and the heaviest of forests are to be found, as in Olaa and the region about Pahoa.

A large part of the soil of upper Olaa is ash which probably came from Kilauea; the great fertility of this soil is due to the decayed vegetable matter which has been added to it.

There are no streams or springs in Puna, the only dependence for water being tanks.

The Olaa section of Puna is a fine agricultural region, but, owing to the want of a market, small-truck farming does not pay. However, vanilla, tobacco, pineapples, and bananas grow well; and the rubber industry is destined to be an important one, as the climate is particularly well adapted to the growth of rubber trees. The cultivation of coffee in Olaa has been abandoned, as the trees did not thrive there.

All the lower lands of Olaa are planted with the cane of the Olaa Sugar Company. This is one of the largest plantations on Hawaii, and occupies nearly all of the available cane land of the Puna district, including the Kapoho and Pahoa tracts.

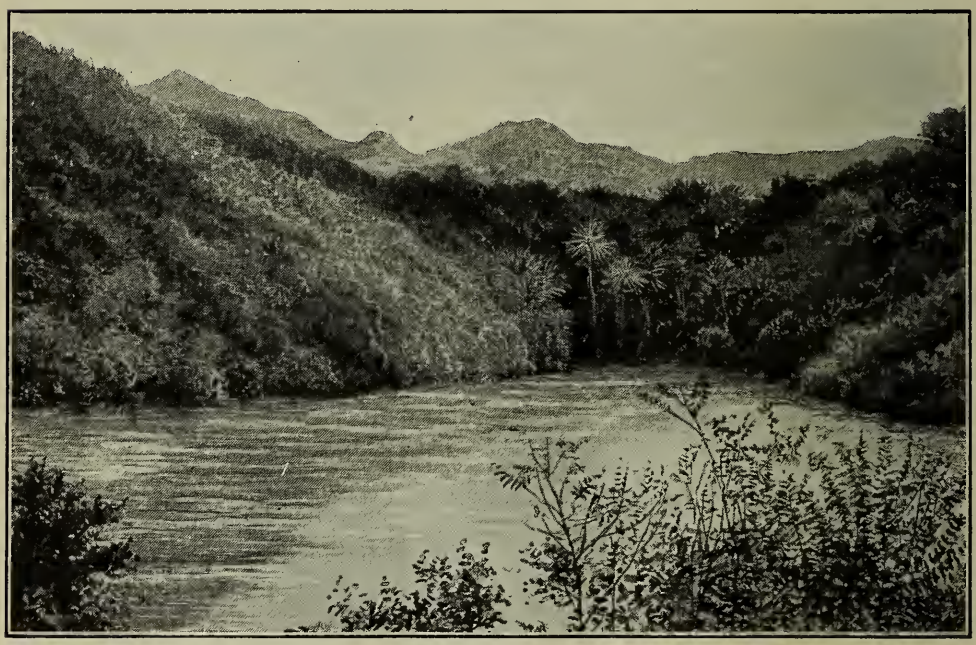
The Hilo Railroad winds through the Olaa cane fields, extending as far as the twenty-two mile post on the Volcano Road. This is a splendidly built, broad-gauge road. Branch roads have also been built to Kapoho and Pahoa.

The chief places in Puna are Keaau (Nine Miles), Mountain View, Pahoa, Kapoho, and Kalapana. The Puna landings have all been abandoned. South Puna is but thinly settled and too rocky ever to be of much use.

A long section of the Puna coast, thirty or forty miles, shows evidences of having sunk: cocoanut trees are found below the tide level, or their dead stumps stand out in the sea.

At Kapoho there is a warm spring; this is a pool about sixty feet in length and thirty feet wide, with a depth of twenty-five

LAVA TREE CASTS, PUNA.



GREEN LAKE, PUNA.

feet, filling a cleft in the lava rock. The water is remarkably transparent and buoyant, and is of blood heat.

Other interesting features of Puna are: the lava tree casts found in the forest above Kapoho; Green Lake, a pretty pond of water in a volcanic cone at Kapoho; the bowlders strewn along the coast near Pohoiki by the great 1868 tidal wave; the heiau of Wahaula in farthest Puna. (A facsimile in miniature of this heiau as it would appear if restored is to be seen in the Bishop Museum.)

Kau. — Near the sea in Kau there is a low belt several miles in width which is hot and dry, but above this the land rises abruptly, and has a good rainfall. Upon this highland cane is planted, and grows well without irrigation. The section cultivated with sugar cane is the older portion of the district; being higher it was not covered with lava.

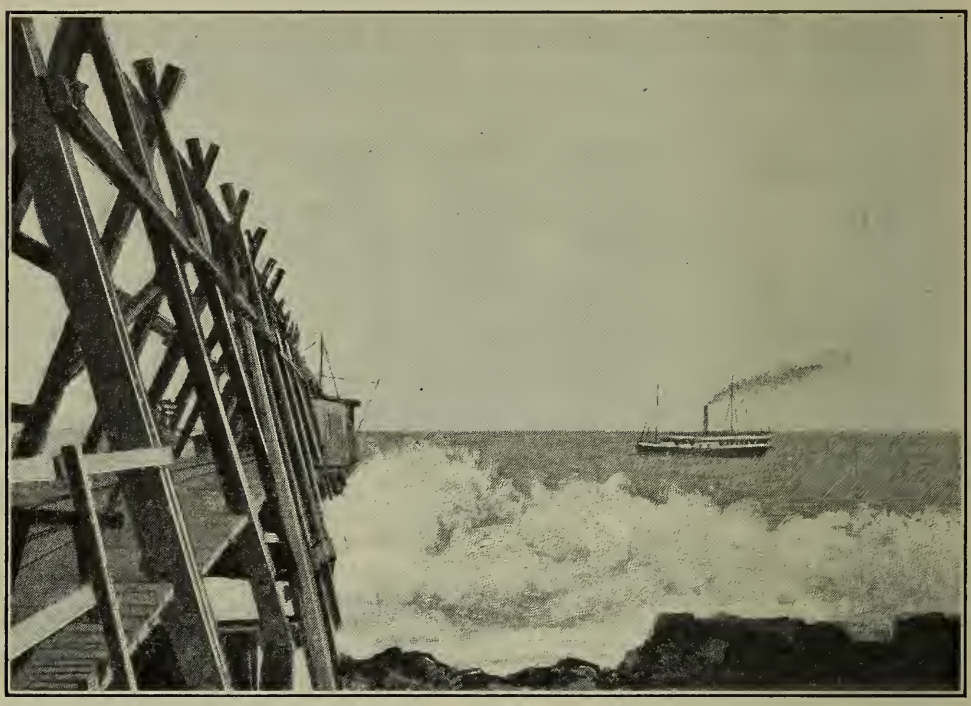
With the exception of a few small gulches, Kau is entirely without valleys and streams — the so-called Wood Valley is nothing more than a depression in the mountain side made by just such a catastrophe as that which caused the Mud Flow. Mountain springs have been developed and storage reservoirs built so that the plantations have sufficient water to irrigate some of their lower fields and flume nearly all the cane to the mill.

There are two plantations in Kau: the Pahala, or Hawaiian Agricultural Company, and Naalehu and Hilea, which comprise the Hutchinson Sugar Company. Pahala is one of the largest and best plantations on Hawaii. Cane is planted higher here than in any other part of the group. The Hilea Mill is at Honuapo. Each plantation has a railroad to the landing — Pahala shipping its sugar at Punaluu, and Naalehu and Hilea at Honuapo. Honuapo is the chief landing of Kau.

Kapapala and Kahuku are cattle ranches. They occupy chiefly the lava regions of Kau. The 1868 and 1887 flows covered the best of the Kahuku pastures.

Besides the landings and plantation settlements, the only other place of importance in Kau is Waiohinu. (The landings

at Kaalualu and Keauhou have long since been abandoned.) Waiohinu was a flourishing place at one time, being the chief market for barter and trade of a large farming population occupying the land between the village and Kahuku. But these people have gone elsewhere, and the town has lost its prestige.



HONUAPO LANDING.

In olden times Kau had a large native population. These people cultivated upland patches, but lived chiefly near the sea. Their favorite place seems to have been the lava region from Honuapo to Punaluu. Near Punaluu a large underground stream runs into the sea, and at other points along the coast there are springs, which accounts for the selection of this dreary spot for a home by these people.

Kona. — The entire Kona district is composed of partly decomposed lava flows. There are very few level patches in the district, and no place where a baseball ground or a polo field could be laid out.

There are no gulches or streams, and but few springs in the

district. Small freshets cross the road in a few places in North Kona when it rains heavily, but are lost in the rocks before they reach the sea. There is only one such place in South Kona, where, during a storm, the water may be heard roaring above, though it scarcely ever crosses the road.

There is a warm, dry belt near the sea throughout the district, but above this the land rises abruptly into a cool and bracing climate, where rain is plentiful.

Road building is difficult and expensive in Kona, owing to the abrupt slope and rocky nature of the district; hence there is but one main road which extends the entire length of the district. This road is from one to four miles above the shore. Branch roads extend to all of the landings, but all other places must be reached by trails. Donkeys are used entirely for transportation over these trails. A great many of these useful animals are found in Kona.

Like Olaa, this district is one of the finest agricultural sections in the group; everything grows well here, even though seemingly planted right among the rocks. However, many things cannot be cultivated with profit, owing to the distance from any market and the expense of transporting produce to the landings.

The chief industry of Kona is coffee — everywhere there are coffee fields. Most of these fields are cared for by Japanese. There are several good coffee mills in the district, where the coffee is prepared in the best way for market. Pineapples, sisal, vanilla, and tobacco are also grown.

Cane planting is not carried on so extensively in Kona as it is in the other districts, because cultivation and transportation are difficult, owing to the rocky nature of the ground, the abrupt slope, and the lack of running water.

On the upper slopes of Hualalai and Mauna Loa, which afford fine grazing land, there are a number of cattle ranches. Owing to the rocky nature of this region, cattle driving is difficult and hazardous.

Kailua and Holualoa are the most important places in the northern section of Kona. Holualoa is the largest place in Kona;

Loading Cattle at Kailua.

it is strung out along the road above Kailua. Kailua is the landing of North Kona. There are two complete coffee mills here, where the coffee is pulped, dried, husked, and selected for market. Kailua's most striking feature is its great stone church,

OLD PALACE, KAILUA.

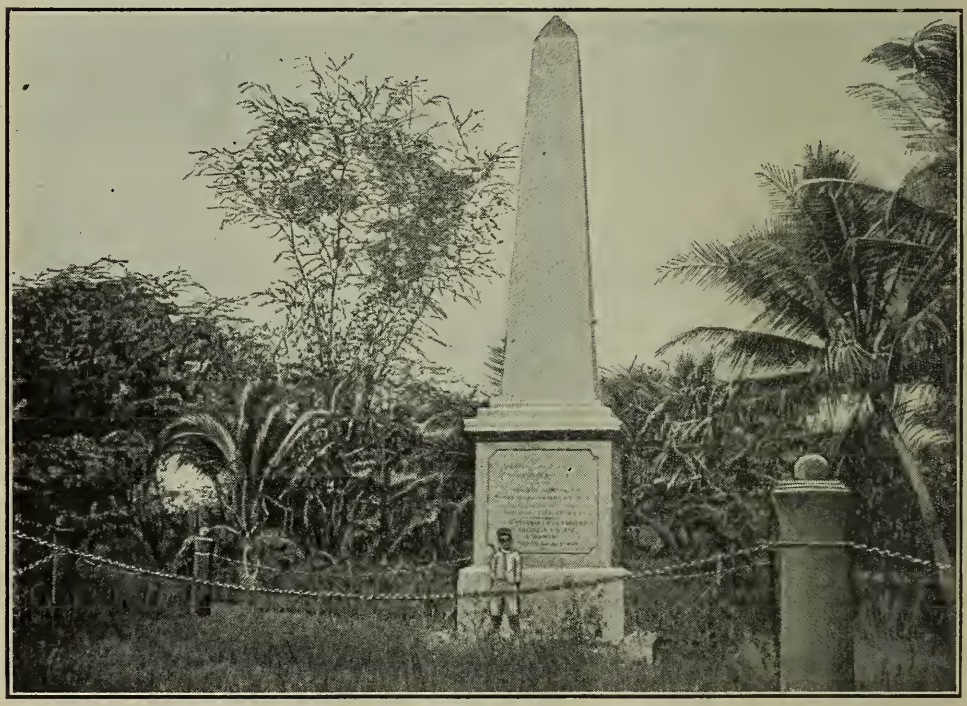
built in the year 1835, when there was a large native population in this region.

Many of the places in Kona are so much scattered along the upper road, or divided between that road and the seashore, that it is a little difficult to name them.

The chief places in the southern section of Kona are: Kainaliu, Napoopoo, Honaunau, and Hookena. As in North Kona, the places are strung along the road, or divided between the road and the shore. There is a pineapple cannery on the road a short distance above Napoopoo.

Honaunau is now two miles inland, there being but a few huts where the ancient village stood by the sea.

FISHING VILLAGE, KONA.



COOK'S MONUMENT, ON KEALAKEKUA BAY.

The landings for Kona are: Kailua, Keauhou, Napoopoo, Hookena, and Hoopuloa.

In ancient times Kona was one of the favorite places of the natives, and had a large population. These people lived chiefly along the seashore, where it was warm and dry, and where the placid waters afforded the best of fishing. Trips were made inland to the forests, where dry-land taro was planted.

Kona abounds in places and objects of historic interest: as, the famous City of Refuge at Honaunau; Kaawaloa (on Kealakekua Bay), where Cook was killed; the great stone toboggan slide just above Keauhou; the Judd road, extending from the shore between Kailua and Keauhou in a direct line fifteen miles towards Hilo; the stone wall built to exclude the pigs from the agricultural land above, and running through the entire district.

An obelisk has been erected at Kaawaloa to the memory of Captain Cook, bearing the following inscription: —

IN MEMORY OF
THE GREAT CIRCUMNAVIGATOR
CAPTAIN JAMES COOK, R.N.
WHO
DISCOVERED THESE ISLANDS
ON THE 18TH OF JANUARY, A.D. 1778
AND FELL NEAR THIS SPOT
ON THE 14TH OF FEBRUARY, A.D. 1779

THIS MONUMENT WAS ERECTED
IN NOVEMBER, A.D. 1874
BY SOME OF
HIS FELLOW COUNTRYMEN

Though Cook was killed at Kaawaloa, it was at Napoopoo that he landed and did his bartering with the natives. Napoopoo is on the opposite side of the bay, and the chief settlement is here.

The City of Refuge occupies six or seven acres of a low, rocky (pahoehoe) point on the south side of the little bay of Honaunau. The inclosing walls on the south and east sides are still standing, but the others have been destroyed by tidal waves. The walls are about twelve feet in height and eighteen feet in width. The Hale-o-Keawe stood upon the platform of rock, at

City of Refuge, Honaunau, Kona.

the northeast corner, facing the bay. Below this there is a larger platform, which marks the site of the lower temple. On either side of this latter platform there are two huge altar stones — called Keoua's and Kaahumanu's stones.

MAUI

Physical Features. — The Maui group, including Maui, Molokai, Lanai, and Kahoolawe, is midway between Hawaii and Oahu, Maui itself being nearest to Hawaii.

While Maui is second in size of the Hawaiian Islands, containing 728 square miles, it is five and one half times smaller than Hawaii.

Maui is a double island, with the smaller lobe lying towards the northwest. It has no distinct promontories or capes. Kauiki Head is the rim of a crater which incloses on one side Hana Bay. The so-called Kahakuloa Point is but one of a succession of points, being prominent because of its peculiar formation rather than because of its size.

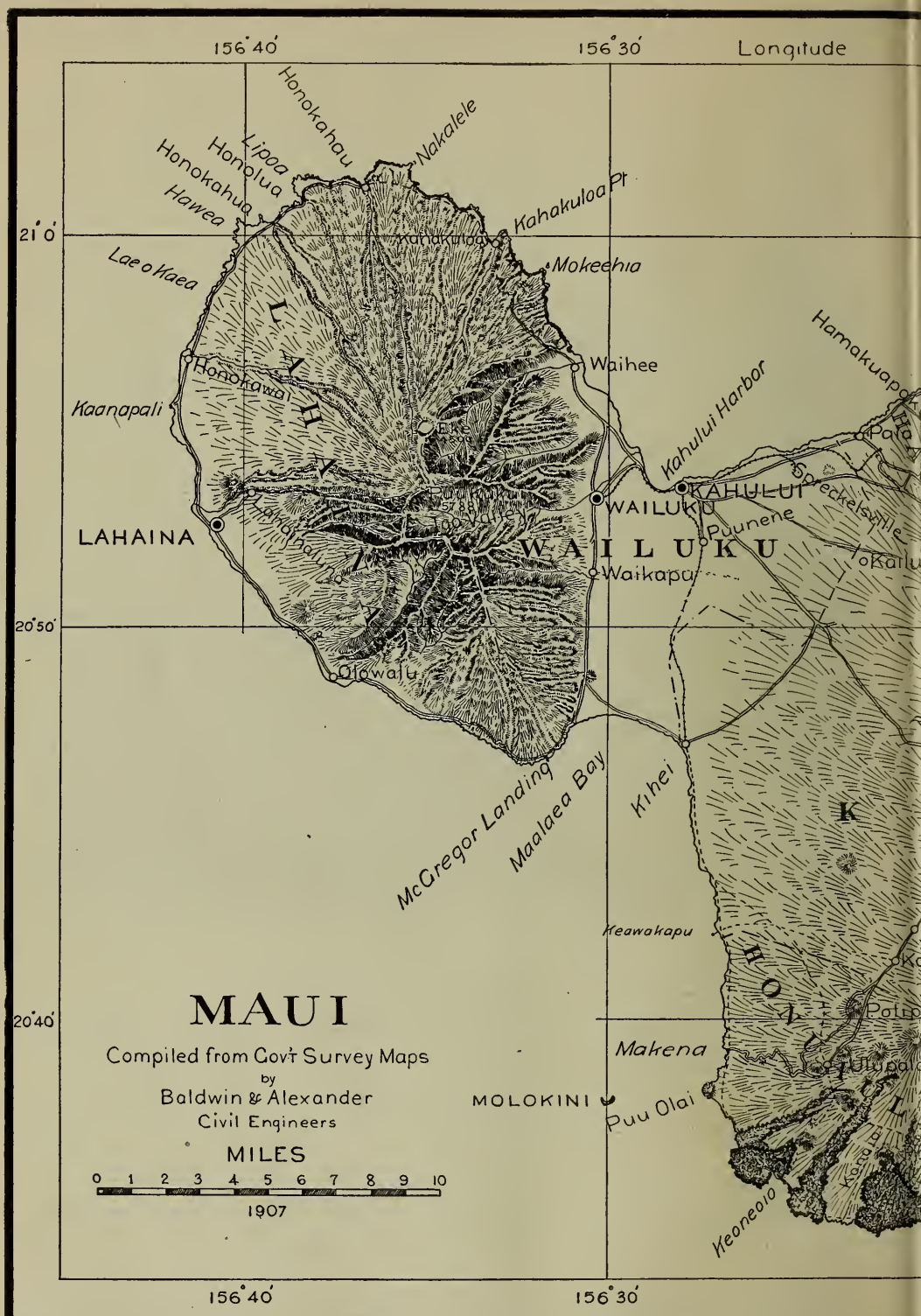
Maui is made up of two distinct mountain masses joined by a low, flat isthmus. Haleakala occupies the whole of the eastern section, comprising the larger part of the island, while the West Maui Mountains fill the smaller or western section of the island.

On the north and south sides of the isthmus are the bays of Kahului and Maalaea, respectively. On the north side the coral has built out from the mainland on both sides, forming the Kahului Harbor. Through the opening in the reef there is a deep channel which the largest vessels can enter.

Along the northeast coasts of both Mauis there are cliffs, but they are not of great height.

Off the Lahaina side of West Maui there are extensive coral reefs and a sand beach extending many miles along the shore. Much coral is also found about East Maui, where the conditions are favorable for its growth, but, as this part of the island is much newer than the other, the reefs are of course not so extensive.

West Maui Mountains. — The West Maui part of this island is much older than Haleakala, being possibly as old as the island


156°40'
156°30'
Longitude
21°0'
20°50'
20°40'
Honokahau
Nakalele
Lipoa
Honolua
Honokahua
Hawea
Kahakuloa Pt
Kahakuloa
Mokeehia
Lae o Kaea
Honokawai
Kaanapali
WEST MAUI
Waihee
Kahului Harbor
Hamakuapoko
KAHULUI
WAILUKU
Spreckelsville
Puunene
Pukalu
LAHAINA
Waiehu
EAST MAUI
Waikapu
Olowalu
McGregor Landing
Maalaea Bay
Kihei
Keawakapu
Makena
MOLOKINI
Puu Olai
Keoneoio
MAUI
Compiled from Gov't Survey Maps
by
Baldwin & Alexander
Civil Engineers
MILES
0 1 2 3 4 5 6 7 8 9 10
1907

West from
156°10′
Greenwich
156°0′
21°0′
20°50′
20°40′
Halehoku
Huelo
Kailua
Honomanu
Keanae
Nahiku
Huaa Pt
Kaupakuluaa
Kakoma
Makawao
Ruu Pane
Polakau
Waiakoa
Keawaiki
Hana Bay
Kauiki Head
Hana
Alau
Hamoa
HALEAKALA CRATER
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Kipahulu
Ahole
Kaupo
Mokulau
Ka Lae o Kalilio
Nuu
Luala'ilua
MAUI
KOOLAU
HANA
KAUPO
AHIKINUI

of Kauai, the Waianae range of Oahu, or the Kohala Mountains of Hawaii. At one time West Maui was probably such a mountain as Mauna Kea, on Hawaii — its crater being filled and completely obliterated, as is the case with Mauna Kea.

As these mountains are stretched directly across the track of the trade winds, they have been subject to a very heavy rainfall, and have been tremendously cut up, furnishing as fine an example of erosion as can be found anywhere. So great has the cutting been that it is difficult for us to imagine that the great gulches we find here, such as Iao, Waihee, Olowalu, and Honokahau, are purely the result of erosion. However, we have examples on a smaller scale with just such results as we find here; so undoubtedly the great amphitheaters at the head of these valleys are areas of erosion, and not old craters, as we might suppose them to be at first sight.

The highest peak of West Maui is Puu Kukui, 5788 feet high.

The scenery in the Iao Valley, which is the most accessible of the West Maui gulches, has been described as being almost equal to that of Yosemite, but that of Waihee and Olowalu is fully as fine. The view from the top of Puu Kukui, looking almost perpendicularly down into the wonderful gorges of Iao and Waihee and out over East Maui and the top of Haleakala to the snow-capped mountains of Hawaii, is said to be one of the finest in the world.

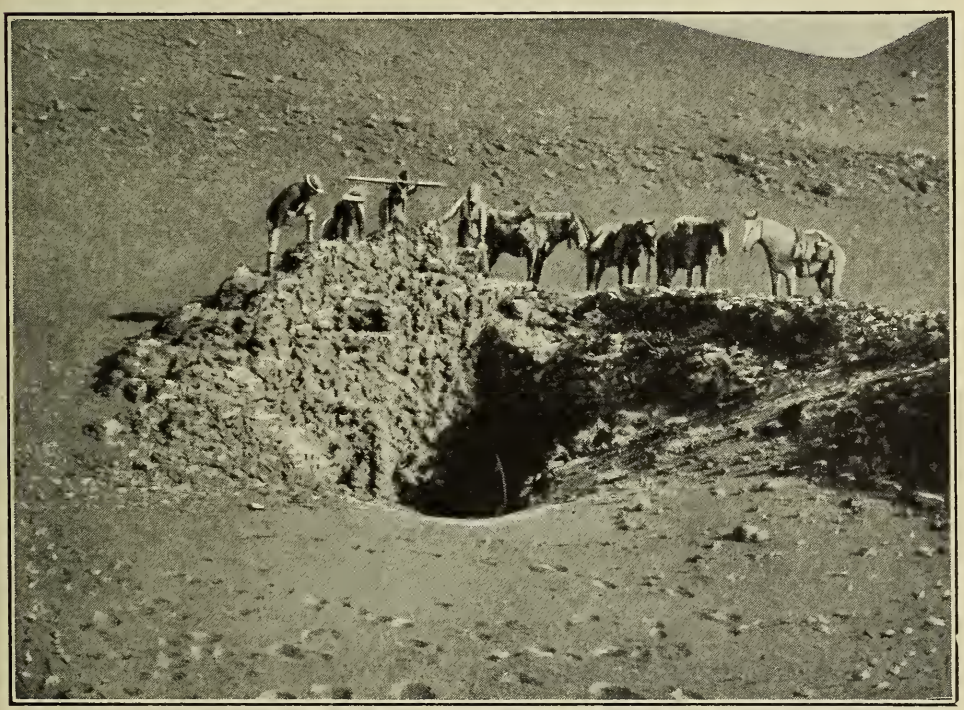
Owing to the narrowness of the ridges and the dense vegetation which covers them, these mountains can be scaled in only a few places. There was once a way from Lahaina to Wailuku over the dividing ridge between the Olowalu and Iao valleys, known as the Olowalu Pass, but this road is now impassable, owing to landslips.

On a narrow ridge between the Waihee and Honokahau valleys is the crater of Eke, the uniqueness in the position of which is due entirely to erosion. This crater, which is a small one, is very inaccessible, having been only once visited by a white man.

Near the summit of Puu Kukui there is an extensive bog or marsh, which is the source of all the streams on the Lahaina

Keanae Valley on one side. The Kaupo gap descends abruptly to the sea, while that on the Koolau side has a gradual incline for most of the distance. There is a trail through the Kaupo gap which is used by cattlemen.

Next to the gaps the most striking feature of Haleakala is its sand cones. There are thirteen cones in the crater, seven of which are sand cones, one of them being over 700 feet high. These cones, which are placed over vents in the lava of the



"Bottomless Pit," Haleakala Crater.

crater, contain craters from which was erupted the sand of which they are formed and which so thickly covers the bottom.

Growing in the sand of the cones, or from crevices in the floor of the crater, are numbers of silver-swords (Argyroxiphium). These curious and interesting plants are not found anywhere else in the world.

Other interesting features of the crater are: the Bottomless Pit (a blow-hole); Pele's Pigpen (a small, partly filled crater); Hunter's Cave; Crystal Cave and the Chimneys; and the

SILVER-SWORD IN BLOOM, HALEAKALA CRATER.

SAND CONE IN HALEAKALA CRATER.

Natural Bridge, — the four last-named are craters along a rent which marked one of the eruptions within the crater.

Judging from the lava flows found in its bottom, the crater of Haleakala may have been active two or three hundred years ago.

A well-marked trail leads from Makawao to the summit of the crater, where a stone house affords shelter and water, but travelers must carry their own provisions and blankets. The trail into the crater, with the exception of three miles along the brink, is a good one.

The side of Haleakala exposed to the wind is cut up into a countless number of gulches. These gulches are large near the seacoast, but do not extend far up on the mountain side. The Keanae Valley is the extension of the Koolau gap. The Kipahulu Valley, which is separated from the crater by a narrow precipitous ridge, was caused by that portion of the land between the Kaupo gap and the valley splitting away from the main body and not sliding as far, when the fault occurred which formed the crater.

On the wedge-shaped piece on the northeastern side of the crater is Lake Waianapanapa, directly above the head of the Kipahulu Valley.

The southeastern slope of Haleakala is barren, a portion of it being covered with lava flows; some of these flows are quite recent — being perhaps one hundred and fifty years old.

The northwestern slope of the mountain, being protected from the wind, presents an almost unbroken stretch to the isthmus.

The Isthmus. — The isthmus which joins East and West Maui is eight miles wide at its narrowest point. At one time this isthmus must have been a water way, — when the Mauis were separate islands. This channel was filled by flows from Haleakala, and was probably higher at one time than it is now. The isthmus is now composed of wash from the high land on both sides, and sand blown from the Kahului beach.

The sand dunes of the isthmus near Wailuku were no doubt caused by an upheaval of this part of Maui, as they are two

hundred feet high and contain fragments of coral and sea shells; but the sand hills on the lower part of the isthmus are the product of the wind.

Formerly numbers of these dunes could be seen slowly moving across the isthmus, finally being lost in the sea on the opposite side; but most of the isthmus land has now been reclaimed by irrigating ditches, and the rest is rapidly being covered with algaroba trees — hence but a few of these traveling dunes are to be seen to-day.

Districts. — The districts of Maui are Lahaina, Wailuku, Makawao, and Hana.

Lahaina. — The Lahaina district includes all of the northern, the western, and a part of the southern slope of the West Maui Mountains. The island of Lanai is also included in this district.

This district, being mostly sheltered from the wind, is a dry one, receiving rain only during the Kona season. Though the main part of the district is practically a rainless one, yet it is well supplied with water from many never-failing streams whose source is the Puu Kukui watershed.

There are two plantations in this district — the Pioneer Mill Company, at Lahaina, and the Olowalu Company.

The Pioneer Mill Company is one of the oldest sugar plantations of the group. By means of artesian wells, tunneling in the mountains, and a long ditch from the Honokahau Valley, water has been developed, so that this is now one of the largest and most prosperous plantations of the Territory. The cane land of this plantation comprises that on the Lahaina flat, the slopes back of the town, and the lower part of the Honokawai lands. The sugar is carried out by railroad to Black Rock (Kaanapali Landing), where it is shipped. The largest vessels can come close in shore here.

The Olowalu Company is a small plantation situated on the flat near the mouth of the Olowalu gulch.

At Honolua is a cattle ranch which embraces the larger part of the lands on the northern part of West Maui.

DESERTED MISSIONARY HOME, LAHAINA.

The only place of importance in this district is the village of Lahaina. At one time the town occupied the whole flat, but now most of this flat is planted with sugar cane, the main part of the town being strung out along the shore. There is a protecting coral reef here, with a break through which boats may enter and find safe anchorage.

Lahaina was the ancient capital of the group, and was then a large and flourishing town. The prosperity of the place was largely due to the whaling fleet which made this a port of call for water and supplies during its cruise in the north Pacific. It took from one to three years to secure a full cargo of oil, and then the ship sailed for New Bedford by way of Cape Horn. At one time there were as many as 89 whaling ships anchored off the town.

The port of Lahaina is an open roadstead, but is entirely sheltered except from the Kona winds; and as these winds blow

only for short periods during the winter months, the harbor is usually a safe one.

Two and a half miles above Lahaina on the hillside is the Lahainaluna Seminary. This school was established in the year 1831, and was long the leading institution for the education of Hawaiian youth. In the year 1905 the school was furnished with new buildings, and is now one of the leading industrial schools in the Territory.

Old Ruin, Lahaina.

Wailuku. — The Wailuku district includes also the island of Kahoolawe and the detached land of Honuaula on the southern part of the island.

That part of the district adjoining the West Maui Mountains is abundantly provided with water from the Iao and Waihee streams, and is occupied by the plantation of the Wailuku Sugar Company.

The lands of the isthmus are supplied with water from a ditch from the Waihee stream and from two long lines of ditches running far along the northeast slopes of Haleakala. By means of the water conveyed in these ditches, what was once a dust-swept and sandy plain has been converted into the finest and largest sugar estate on the Hawaiian Islands — that of the Hawaiian Commercial and Sugar Company. The mill for this estate is situated at Puunene, and is the largest sugar mill on earth. The cane is carried by railroad to the mill from every part of the plantation. Besides the ditch, there are a number of wells from which water is pumped during dry times.

The principal places of the district are: Wailuku, Waihee, Kahului, and Puunene.

PUUNENE MILL.

WAILUKU TOWN AND IAO VALLEY.

Wailuku is a town of 3000 inhabitants, and is the county seat for the county of Maui. It is a pretty village situated at the mouth of the Iao Valley. It was in the Iao gulch near the village that Kamehameha defeated Kalanikupule, the king of Oahu and Maui, in the famous battle of Wailuku — when it is said the stream ran red with blood. It was by this victory that Kamehameha made himself master of Maui.

Kahului is the port of the district, though passengers and mail are frequently landed at McGregor Landing on Maalaea Bay as well. The harbor has been enlarged by dredging, and protected by a breakwater built on the eastern side, and can now accommodate the largest ocean-going vessels. Kahului is connected with all the neighboring places by railroad, and is a busy port during the sugar season.

Makena is the port for the Honuaula part of the district.

Makawao. — The Makawao district, which includes Kula, covers the larger part of the northwestern slope of Haleakala. As it is mostly on the sheltered side of the mountain, the district is not cut up by many gulches; it presents an almost unbroken incline to the isthmus.

As there are no running streams of water in the main part of the district, two ditches have been constructed for the purpose of bringing water from the windward slopes of Haleakala. The first of these ditches (Hamakua ditch) was completed in the year 1877, and was the first ditch of its kind on the islands. The other (Koolau ditch) was completed in 1905; it extends as far as Nahiku, and brings the water out at a much higher elevation than the other. Seven and a half miles of this latter ditch is through tunnels, and three great gulches are crossed — Honomanu, Halehaku, and Maliko.

The water from these ditches is used for irrigating the cane of the Maui Agricultural Company, enabling this estate to extend its bounds into the fertile lands on Haleakala.

The Hamakuapoko and Paia plantations have been consolidated into the Maui Agricultural Company, with a central mill located at Paia.

The upper part of Kula is entirely sheltered from the trade winds, has a climate different from that of any other part of the group, and is particularly suitable for persons suffering with tuberculosis. The black soil found here is a vegetable loam; at one time this region was covered by a heavy forest growth, which was cleared away by settlers, or destroyed by cattle. The soil of Kula is very rich, and good crops of corn and potatoes are raised here.

At Haiku there is the cannery of the Haiku Fruit and Packing Company, which harvests from the adjoining lands a large crop of pineapples.

The upper slopes of Haleakala are used for grazing purposes.

Makawao has a larger number of white people and more social life than any other of the outer districts. This is due not only to the fact that a large proportion of the whites are of the more intelligent class, but also to the fact that the different villages are placed about a common center, instead of being strung along the coast as is usual with most of our island communities.

There are a great many Portuguese in this district — many of whom have settled in Kula and Kaupakulua as farmers.

In the upper part of Paia is the Maunaolu Girls' Seminary. A well-equipped foreign church is centrally located below the seminary, where it is easily reached from all parts of the district.

The principal places of the district are Paia, Hamakuapoko, Makawao, and Kihei.

Hana. — The Hana district is made up of the lands of Kahikinui, Kaupo, Kipahulu, Hana, and Koolau, occupying the eastern end of the island.

Kahikinui and Kaupo, being on the southern or sheltered slope of the mountain, are largely waste land; they are used chiefly for grazing purposes.

In contrast to that part of the district on Haleakala's southern slope, the eastern and northern section has a heavy rainfall, possessing a climate somewhat similar to portions of Hilo on Hawaii.

There is a good driving road from Kipahulu to Nahiku, but beyond this there is only a trail. This trail extends along the greater part of the northern slope of Haleakala, which is very much cut up by gulches. Formerly this trail was near the seashore, but now it has been built higher up on the slope of the mountain, where the gulches are small; and so the deep valleys, with their fords which are dangerous in the rainy season, are avoided. The scenery along this trail is very fine.

There are two small plantations in this district: those of the Kipahulu Sugar Company, and the Kaeleku Plantation, at Hana.

Rubber is grown successfully at Nahiku in this district, and this is an important industry. Nahiku is a region similar in soil and climate to Olaa on Hawaii.

Hana district has a scattering and sparse population.

The principal place of the district is Hana town, which is picturesquely situated on the bay just back of Kauiki Head. The only good landing in the district is at Hana; large ships can find a safe anchorage in the bay here.

Keanae is a village at the mouth of the Keanae Valley. It is built partly on the peninsula formed by the lava which flowed into the sea through the Koolau gap.

Kaupo is a small place just below the gap from which it takes its name.

During ancient times Hana Bay was a convenient landing for canoes coming from Hawaii. In times of war Kauiki hill was used as a fort. A paved road was built around East Maui in the sixteenth century; on the hillsides the flat cobblestones of which it was made were placed on edge. Portions of this ancient road are still in use.

MOLOKAI

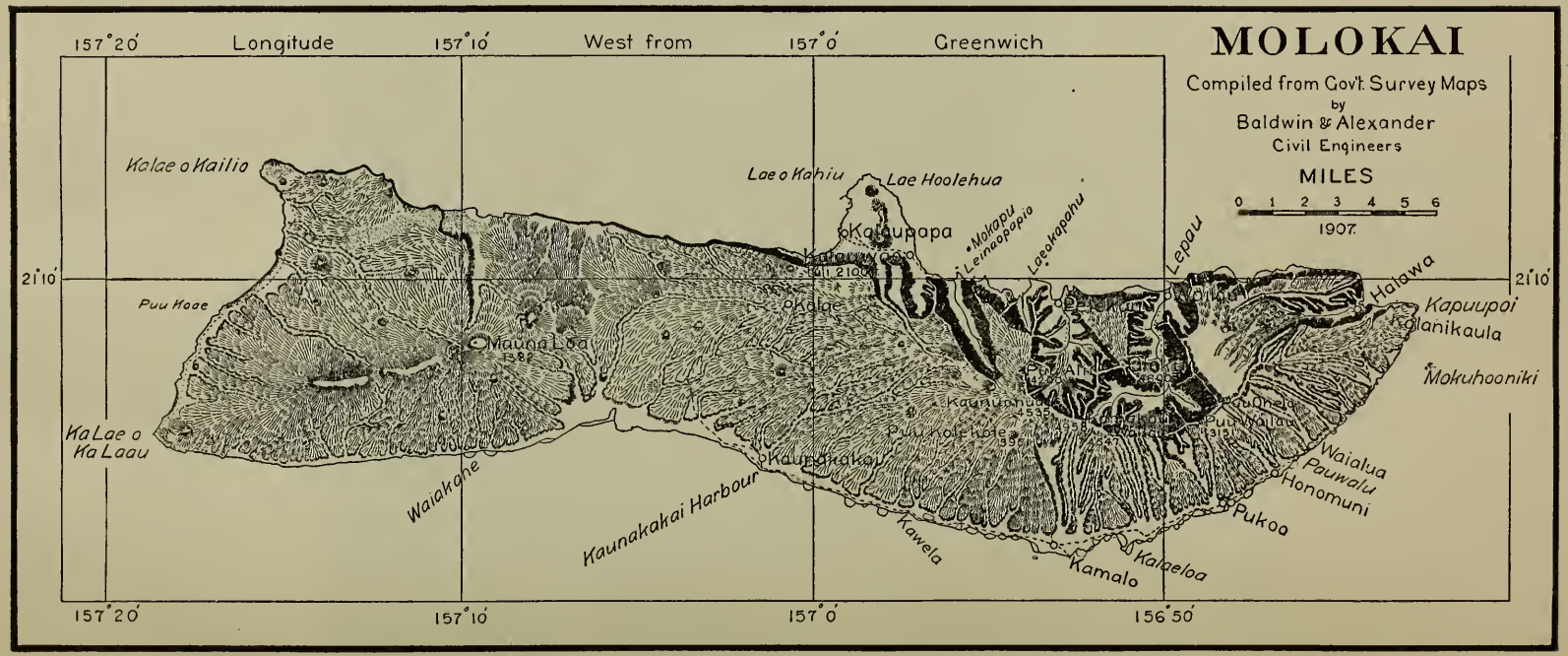
Physical Features. — Molokai is a long, narrow island lying east and west directly between Oahu and Maui.

The island, which is about forty miles long by ten miles wide, can be included in a rectangle whose length is four times its width.

Cliffs seen from Leper Settlement, Molokai.

The north coast is bold and rugged, showing on the northeast end extraordinary cliffs like those found on the windward side of Hawaii and on the northwest coast of Kauai.

An extensive barrier reef extends along the entire southern shore, which is low. At Kaunakakai, Kamalo, and Pukoo this reef has made excellent harbors.


MOLOKAI
Compiled from Gov't. Survey Maps
by
Baldwin & Alexander
Civil Engineers
MILES
0 1 2 3 4 5 6
1907.
157°20′ Longitude 157°10′ West from 157°0′ Greenwich
21°10′
Kalae o Kailio
Lae o Kahiu
Lae Hoolehua
Kalaupapa
Mokapu
Leinaapapa
Leeakapahu
Lepau
Halawa
Kapuupoi
Olanikaula
Mokuhooniki
Puu Hoae
Mauna Loa
1381
Kalae
Kaunuhuu
1535
Puu Kolekole
Kaunakakai
Ka Lae o
Ka Laau
Waiakahe
Kaunakakai Harbour
Kawela
Kamalo
Kalaeloa
Pukoo
Honomuni
Paumalu
Waialua
Puu Nana
Puu Nana
156°50′

Molokai is a double cone. The smaller cone, which lies towards the west, is dry and barren, and of no commercial value.

The highest point of the larger, or eastern, section of the island is Kamakou, 4958 feet above sea level. This peak is at the south end of the narrow ridge dividing the Pelekunu and Wailau valleys. The most prominent peak in this section is Olokui, which is on a wedge almost directly north of Kamakou, with which it is connected by the narrow precipitous ridge above referred to.

The formation, which is unusual here, must have been the result of a great fault, when the north side of the mountain broke away and slipped into the sea, forming the cliffs along the coast. Since the fault the region has been cut up by erosion, forming the inaccessible gulches, of which the Wailau and Pelekunu are the largest. All together this is one of the most remarkable sections of the group.

Industries. — Owing to the lack of water in its desirable sections, Molokai is of no great commercial value.

The larger part of the island is devoted to cattle raising. Taro is grown in Pelekunu and Wailau for the leper settlement. Sisal is also grown in places.

Formerly there were a great many fish ponds within the barrier reef along the southern shore of the island, but many of these ponds are not used now, as there is no market for the fish, and the inclosing walls have been allowed to fall to pieces. Some fish are sent to Lahaina and Honolulu.

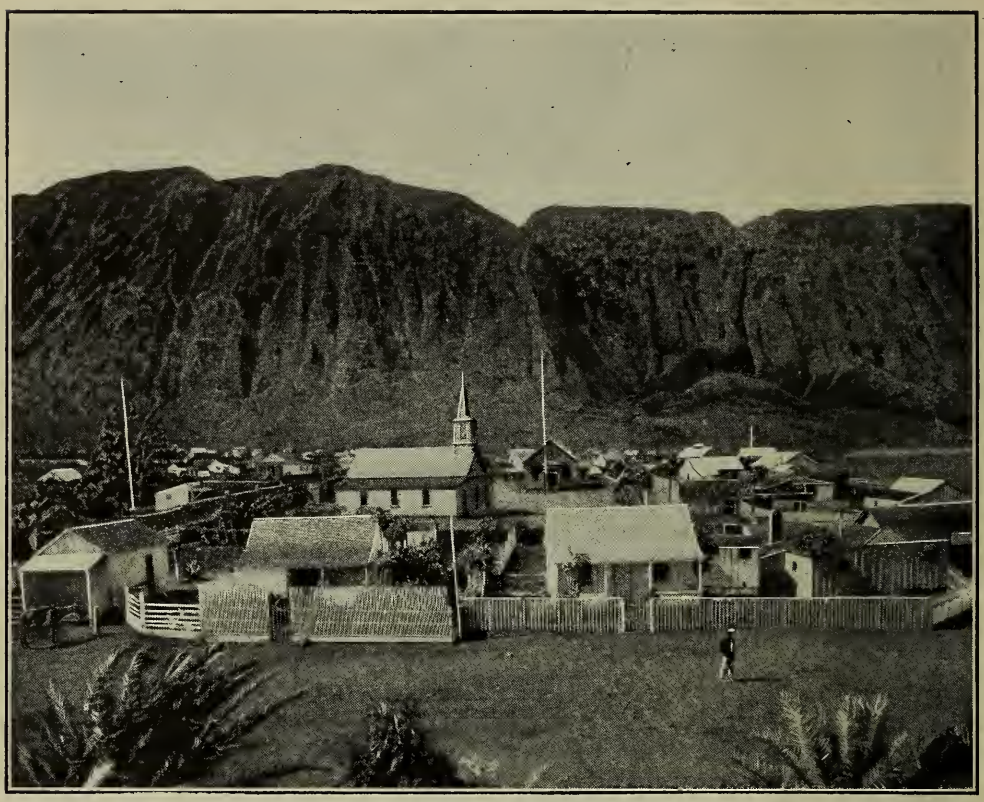
Two of the finest wharves of the group are found at Kaunakakai and Kamalo. That at the former place extends half a mile out to sea. These wharves were built when the Kaunakakai and Kamalo plantations were being exploited.

With the exception of the leper settlement at Kalaupapa, the places of Molokai are of no importance; Wailau and Pelekunu are accessible only from the sea.

Kalaupapa. — At the base of the cliffs near the middle of the north side of Molokai there is a shelf which juts out into the sea,

being an outflow of lava from the Makanaloa crater. The bowl of this crater is at sea level, and is filled with sea water which has a mean depth of 300 feet, falling away to 750 feet in one spot.

Located on this shelf is the leper settlement of Kalaupapa, cut off on the land side by cliffs 1500 feet high and on the other



Leper Settlement at Kalaupapa.

side by the sea. The side of this shelf opposite Kalaupapa is known as Kalawao.

In 1906 there were 831 residents at the settlement, most of whom were lepers. While the lepers are allowed land which they can cultivate, they derive their chief support from the government, which does everything possible to alleviate their unfortunate condition. Separate homes are maintained for the boys and girls of lepers, and also a hospital where all are cared for who cannot assist themselves.

A leprosarium has been established at the Kalaupapa settlement by the Federal Government for the study of the disease of leprosy.

LANAI

Lanai is on the lee side of West Maui, its nearest point being nine miles distant. The island contains 139 square miles.

Lanai is a single cone 3400 feet high. On the west or lee side of the island there are cliffs three or four hundred feet high in places. This side of the island consists of a gently sloping plateau, or a succession of terraces.

Being on the sheltered side of Maui, Lanai does not show much erosion, though there are a number of small gulches. There are some springs on the island and one running stream.

There are small forest trees on the summit, and the plateau on the lee side is fine grazing land, but otherwise the island is barren.

Lanai is devoted to cattle and sheep raising. It is entirely free from noxious weeds.

There are two small government schools on the island.

KAHOOLAWE

Kahoolawe is the smallest of the inhabited islands of the group, containing 69 square miles.

The island consists of a single cone, 1472 feet high. It is almost entirely surrounded by cliffs, which are 200 feet high in places.

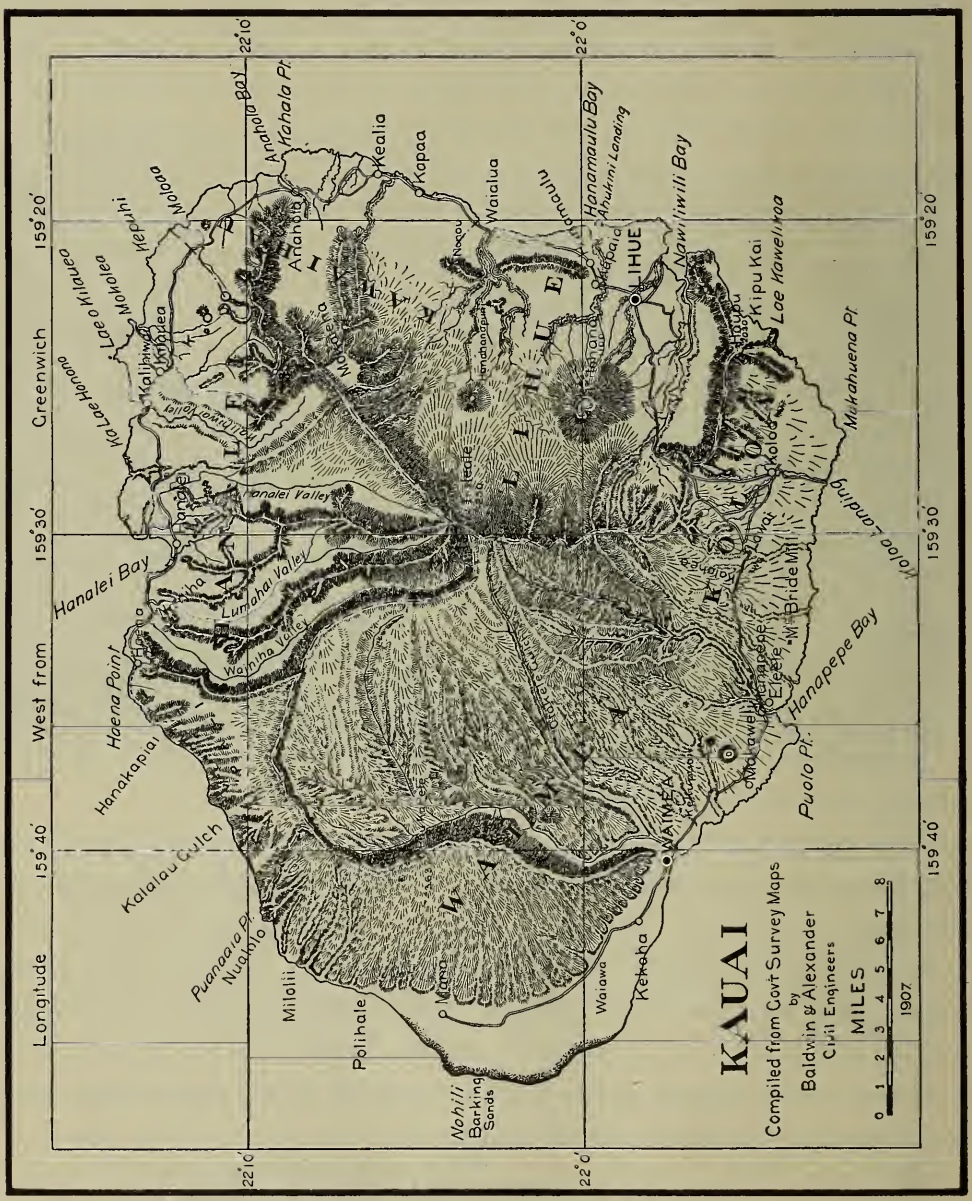
Being on the protected side of Maui, the island presents an even, unbroken surface. There are no streams or even springs on the island.

Kahoolawe supports but a few head of cattle and sheep, and is of hardly any commercial value.

There are only a few herders living on the island.

KAUAI

Physical Features. — Kauai is at the extreme northwest end of the main group, and is the smallest of the four larger islands.



Its area is 547 square miles, which is 51 square miles less than that of Oahu.

Kauai is nearly circular, and, with the exception of the Mana flat, which is composed of an uplifted coral reef, could be included in a circle whose radius is a line from the Nawiliwili lighthouse to a point in the head of the Wainiha Valley west of Waialeale.

The coast line of Kauai is very regular, containing no prominent capes, or bays of any extent. The so-called Haena Point is one of two spurs of the Wainiha ridge, forming a headland

which is separated from the sea by the coastal plain which forms Haena flat. Hanalei Bay, which is as large as Kealakekua on Hawaii, is a typical Hawaiian inlet, with its protecting coral reef and passageway. Nawiliwili Bay, which is the chief port of Kauai, has sea room for only small-sized vessels.

The shore is low, except on the northwest, where there are high cliffs extending along the coast for fifteen miles.

Owing to the depth of water near the shore, there are no coral reefs of any extent. It may be that there were such reefs off the coast of Kauai at one time, but the space between the reef and the shore has been filled with wash from the slopes above, thus adding to the coastal plain.

Waialeale. — Kauai is made up of the mountain mass of Waialeale, 5250 feet high. From the summit the ridges radiate in all directions, though on the eastern side they are very short.

The eastern and northern sides have been tremendously eroded, and on the east there is left scarcely a vestige of the original slope which is indicated by only a few short ridges. The opposite side is furrowed by a number of deep gorges, but the original contour is still preserved in the wide spaces between them, which comprise the upper cane fields of the plantations on this side of the island.

These ridges are low near the sea, and are gradually lost in the coastal plain, but become narrow and precipitous as the gulch extends inland, finally forming a veritable canyon.

The Hoary Head ridge on the southeast is a part of the original backbone of the mountain which was intersected by the gap north of Koloa, through which the government road to Lihue passes. The highest point of this ridge is Hoary Head (Haupu), 2030 feet high.

The Waimea gulch which extends across the western slope of Waialeale, intersecting all the ridges on this side of the island, is not wholly the result of erosion, but originated in a fissure.

Originally Waialeale must have been much higher than it is now; the soil has been washed from the summit and slopes to

form the coastal plain which encircles Kauai, with the exception of the northwest side.

From the amount of erosion that has gone on, we infer that Kauai is the oldest island of the group.

The section of the mountain between the Wainiha and Waimea valleys has a gentle slope towards the latter gulch, and is of a boggy nature. Were it not for the deep Koaieaie gorge which intersects it, this region would consist of almost a continuous swamp. Sections of this bog are covered with a thin turf, and are impassable. In ancient times, it is said, the northern section of the morass was crossed by a path made of logs, but the passage was a hazardous one, for the logs were submerged in places, and it was difficult to find this path in the dense fog which usually covers the mountain.

This swamp is the reservoir which feeds all the streams that go to make up the Waimea, Makaweli, and Hanapepe rivers, making a splendid watershed for the lee side of the island, which is thus abundantly supplied with water, even though it may not rain for months at a time.

Owing to the difficult nature of the trip to the summit, which can be reached only by skirting the bog, Waialeale has seldom been ascended. For many years the true height of this mountain was not known.

Napali. — The northwest side of Kauai, known as Napali, is similar to the windward or North Kohala section of Hawaii, and the northeast or Wailau and Pelekunu section of Molokai, showing remarkable cliffs of the same kind rising almost perpendicularly from the sea to a height of more than a thousand feet in some places. However, it is to be noticed in this case that the cliffs are on the northwest, where they are partly protected from the wind, instead of being on the windward side of the island as in the cases of Hawaii and Molokai.

The gulches in this Napali section are short, ending at the ridge back of Waimea Valley. They show the effects of much erosion in many needle-like shafts and in wide amphitheaters at their heads. In that part of this section farthest south these

gulches enter the sea through narrow, canyon-like walls, cutting off all view of the interior.

The Kalalau Valley is the largest of the gulches in this region. In ancient times there were a large number of natives living here, but only a few huts remain at present. It was among the inaccessible ridges in the head of this gulch that the leper Koolau intrenched himself, eluding all efforts of the authorities to capture him.

Some of the finest scenery in the Hawaiian Islands is to be found in this Napali region, but owing to its inaccessibility the place is seldom visited. There is a trail along the cliffs as far as Kalalau, but beyond this the journey to Mana must be made by a canoe trip of seven miles.

The Olokele Canyon, Kauai.

Valleys. — Kauai is noted for its gulches, which are among the finest in the world. They are longer than the gulches on the other islands, and are very deep in their upper portions, being confined between canyon-like walls. These gulches all contain large streams of water, which, as they spread out on the low, flat lands of the coastal plain, are called rivers.

So inaccessible is the interior of Kauai that its real nature was not known till it was penetrated by the plantation tunnels and ditches in search of water. So the Olokele tunnel disclosed the

wonderful canyon from which the ditch takes its name, and the Kauai Electric Company's ditch opened up the magnificent scenery in the great Wainiha gorge.

The Wainiha Valley is undoubtedly one of the finest of our Hawaiian gulches. This gulch has cut its way between perpendicular walls, several thousand feet high in its upper part, into the very heart of Waialeale, almost intersecting the ridge upon which the peak stands.

The Hanalei Valley contains the largest stream of any of our Hawaiian gulches. It is navigable for boats and small steam launches for three miles. The river is used for transporting the rice grown in the gulch.

Between the Hanalei and Wainiha valleys is the Lumahai. The Lumahai River is now spanned by a bridge, and so has disappeared the last of the Kauai ferries, which were a characteristic feature of travel in this region at one time.

Wailua and Hanapepe are chiefly noted for their beautiful waterfalls. Boats can sail up the former for a distance of a mile and a half. The two branches of the Wailua unite near the sea, where the sea has cut its way through a ridge, forming a deep gorge.

The Waimea Valley plays an important part in the drainage of the west side of the island, intersecting the slope of the mountain on this side and turning all the streams through its own channel toward the south, thus depriving the extreme western section of Kauai of any running streams of water.

The Makaweli gulch has worn away the intervening ridge near the sea, and is now a branch of the Waimea; the Olokele in turn is a branch of the Makaweli.

Secondary or Tufa Cones. — There are a number of secondary cones on Kauai that have played an important part in the general topography of the island. These cones, like those on Oahu, were formed after the island had attained its present state of erosion. Some of the craters in these cones are used as reservoirs by the plantations.

The largest of these cones is the Kilohana crater west of

Lihue, which is 1100 feet high. The material ejected from this crater covers all the region from the Hoary Head ridge to the Wailua River, burying beneath its débris the valleys and ridges that existed here at one time. The streams have been forced to cut new channels through this débris, flowing around the cone into the Wailua River on one side and the Huleia on the other.

In a similar manner the valleys and ridges of the mountain spur on the northeast have been covered up by material ejected from craters in that region. The bowl in one of these craters is used as a reservoir by the Kilauea Plantation.

At Koloa a dam has been constructed across the gap in an old cone, and the lake thus confined furnishes a fine water supply for the plantation.

The cones near the Koloa landing mark the site of a comparatively recent pahoehoe outbreak, which was the last eruption on Kauai.

Haena Caves. — In the cliff at Haena there are a number of caves. Two of them are at sea level and are filled with water, that in one of them being entirely sweet. These caves are enlarged chambers of old lava tunnels, and evidently extend into the cliff for some distance. Owing to the water with which they are filled, it is impossible to explore them. A canoe has been placed in one of the caves for visitors.

Barking Sands. — The barking sands consist of a range of wind-blown sand hills half a mile in length, extending from Nohili towards Polihale. When thoroughly dry, this sand becomes resonant whenever its grains are set in motion.

While these sands are called "barking sands," they emit a great variety of sounds, according to the method of friction; at times the sound resembles subterranean thunder; again it will be a sighing or a faint groaning as of some one in pain; as the wind forms little cascades, there is a rustling sound as from a lady's silk skirts. The act of sliding down the sand hills produces a sound having cadence periods; they were probably named for this.

This phenomenon is a rare one, being common to only a few places in the world. It is said that there is a hill of barking sand at Makua on Oahu. In climate this latter place is similar to Mana, which is one of the hottest and driest spots of the group.

Vegetation. — Kauai has been called the "Garden Island," though it is exceedingly bare of trees except on the higher mountain slopes. However, in former times the whole eastern

KAUAI, THE "GARDEN ISLAND" (WAINIHA VALLEY).

side of the island was covered with a heavy forest growth, which must have presented a very tropical appearance, but has since been destroyed by cattle or replaced by cane fields. Again, owing to the nature of its watershed, the whole island is well watered — this, coupled with a rich soil, no doubt gave it its sobriquet "Garden Island."

Industries. — An almost continuous belt of sugar cane girds the island of Kauai from Mana to Kalihiwai on the north.

All the lowlands of the coastal plain and valley bottoms are planted with rice. The area on the north planted with rice exceeds that of any other part of the group. Rice mills are located at Waimea and Hanalei.

Pineapples are cultivated in sections, and there is a cannery at Lawai.

On the uplands of Kauai there are a number of cattle ranches. At Hanalei buffalo grass has been sown in the fields, greatly improving the pasture.

The splendid water sources of Kauai have not only been utilized to bring under cultivation nearly all of the arable land on

this island, but have been the incentive for a further step in the development of the sugar industry of the group, through the evolution of the tunnel-ditch and the application of electricity on a large scale to the running of plantation machinery.

The Kekaha Plantation[1] completed a new ditch in 1907, bringing the Waimea Valley water into its fields. Previous to this only the land on the low coastal plain was cultivated, but now a portion of the upland is planted as well. Pumps are still used for irrigation in some of the low lands.

A great deal of made land has been added to this estate by the construction of dams, which caused the sediment carried in flood water to drop as its velocity was checked.

Makaweli, which is one of the most prosperous plantations of the group, occupies what was once a dry *kula*, capable of supporting but a few head of horses and cattle. Water was first secured from the Hanapepe Valley, and later from the Olokele canyon, which is the main branch of the Makaweli stream. These two ditches give the plantation an abundant supply of water even in the driest weather. The building of the Olokele ditch was a great engineering feat, the upper portion being a continuous tunnel for six miles within the cliff of the wonderful Olokele canyon.

The McBryde Sugar Company secures its water supply from pumps in the Hanapepe Valley, which are operated by electricity. This electricity is developed by water power in the Wainiha gulch on the opposite side of the island, and conveyed around the mountain to the pumps by a system of wires and poles thirty-five miles long. The cane land of this plantation extends from Hanapepe into Koloa.

Koloa and Lihue are two of the oldest plantations on the Hawaiian Islands. The Lihue Plantation includes Hanamaulu. There is a separate mill at the latter place. Both Lihue and Koloa secure water from mountain streams and a system of storage reservoirs.

At Kealia there are a number of flowing artesian wells.

[1] See Appendix A for list of plantations.

Kilauea is well watered, but the soil here is poor.

All of the plantations of Kauai have their own landings; Makaweli and McBryde ship their sugar direct in deep-water vessels, importing all their supplies in the same way, but the other plantations use Honolulu as the distributing center. A breakwater has been built at Eleele, the landing for the McBryde Sugar Company, making it the best harbor on the lee side of the island. The Lihue sugar is shipped at Ahukini in Hanamaulu Bay, where the vessels can approach close to the wharf.

Districts. — The districts of Kauai are Waimea, Koloa, Lihue, Kawaihau, and Hanalei (including also Napali).

Waimea is the largest of these, occupying the whole western part of the island, which includes the entire dry section of Kauai. This district includes also the island of Niihau.

Hanalei occupies the largest part of the northern section of the island; this is an extremely wet district, having as great a rainfall as Hilo on Hawaii.

People. — A larger proportion of Japanese are found on Kauai than on the other islands, some of the schools being composed almost entirely of Japanese children. There are a great many Chinese also, who are engaged in the rice industry. At Lihue there is a German settlement, where a German church and school are maintained.

In general, the population centers of Kauai are large, five and six-room schools being found in most of the villages.

Places. — Lihue is the county seat of Kauai County. The village is scattered along both banks of the Nawiliwili gulch. Nawiliwili is the port for Lihue. The wireless station is located near the landing.

Waimea village is at the mouth of the Waimea River. At one time there was a large native population here, when it was the capital of Kauai. Captain Cook first landed on the Hawaiian Islands at the mouth of the Waimea River. On the bluff east of the river mouth are the ruins of a Russian fort built in the year 1815, ostensibly for Kaumualii, the king of Kauai, but with the secret purpose of annexing the island to Russia.

Waimea Village.

Koloa is a pretty village near the extreme southeast end of the island. The landing for Koloa is an open roadstead two miles from the village; this was the chief port for Kauai at one time.

Hanapepe, Eleele, and Kapaa are important villages. At each of the plantation mills there are also good-sized settlements.

Hanalei is one of the most picturesque parts of the group. The view looking down into the gulch from the east bank, with the broad river winding through rice fields in the foreground, and the bay and cloud-capped peaks and ridges in the distance, is one of unsurpassed beauty.

Hanalei Valley, Kauai.

There is a small settlement at Wainiha near the mouth of the river; the Kauai Electric Company's power house is located two miles above in the gulch.

NIIHAU

Niihau is 17 miles west of Kauai, from which it is separated by a deep channel. The island contains 97 square miles, and its highest point is 1300 feet above sea level.

This island consists of a high middle section, with a low plain at each end. On the north there are precipitous cliffs where the highland joins the flat. Water is pumped from shallow wells.

The island, which is a private estate, is devoted to sheep raising.

A small white shell is found on the beaches, which is strung into necklaces.

The famous Niihau mats are made from a reed that grows in the marshes. This reed has a red base; otherwise it is similar to the rushes found on other parts of the group. The mats are made chiefly at Mana on Kauai.

With one or two exceptions, the people of Niihau are Hawaiians.

The government maintains a school and road here.

APPENDIX A

OAHU

CAPES	BAYS AND HARBORS	TOWNS AND VILLAGES	PLANTATIONS
Kahuku Point	Honolulu Harbor	Honolulu	Honolulu Plantation Co.
Mokapu Point	Pearl Lochs	Aiea	Oahu Sugar Co.
Makapuu Point	Kaneohe Bay	Pearl City	Ewa Plantation Co.
Diamond Head	Waialua Bay	Waipahu	Waianae Co.
Barber's Point	Kahana Bay	Ewa Mill	Waialua Agricultural Co.
Kaena Point		Waianae	Kahuku Plantation
		Waialua	Waimanalo Sugar Co.
		Wahiawa	
		Kahuku	
		Laie	
		Hauula	
		Waikane	
		Heeia	
		Kaneohe	
		Waimanalo	

MOUNTAINS

	HEIGHT
Kaala Waianae Range	4030 feet
Palikea Waianae Range	3111 feet
Konahuanui	3105 feet
Lanihuli	2775 feet
Tantalus (Puu Ohia)	2013 feet
Olympus (Awawaloa)	2447 feet
Round Top (Ualakaa)	1049 feet
Punchbowl (Puowaena)	498 feet
Diamond Head (Leahi)	761 feet

HAWAII

CAPES	BAYS	PLACES	PLANTATIONS
Upolu Point	Hilo Bay	(Kohala)	(Kohala)
Kumukahi Point	Kealakekua Bay	Puako	Puako Plantation
South Point (Ka Lae)	Kawaihae Bay	Kawaihae	Hawi Mill
	Kailua Bay	Mahukona	Union Mill Co.
		Hawi	Kohala Sugar Co.
		Kapaau	Halawa Plantation
		Makapala	Niulii Mill Co.
		Waimea	(Hamakua)
		(Hamakua)	Pacific Sugar Mill
		Waipio	Honokaa Sugar Co.
		Kukuihaele	

(*Continued on next page.*)

MOUNTAINS

	HEIGHT
Mauna Kea	13,825 feet
Mauna Loa	13,675 feet
Hualalai	8,269 feet
Kohala Mountains	5,489 feet
Crater of Kilauea	4,000 feet

HAWAII — *Continued*

PASSENGER AND MAIL LANDINGS	PLANTATION LANDINGS	PLACES	PLANTATIONS
Kawaihae	Honoipu	Honokaa	Pauhau Sugar Plantation Co.
Mahukona	Kukuihaele	Paauhau	Hamakua Mill Co.
Laupahoehoe	Honokaa	Paauilo	Kukaiau Mill Co.
Hilo	Paauhau	Kukaiau	Kukaiau Plantation Co.
Honuapo	Koholalele	(Hilo)	(Hilo and Puna)
Hoopuloa	Ookala	Ookala	Ookala Sugar Plantation Co.
Hookena	Papaaloa	Laupahoehoe	Laupahoehoe Sugar Co.
Napoopoo	Honohina	Papaaloa	Hakalau Plantation Co.
Keauhou	Hakalau	Hakalau	Honomu Sugar Co.
Kailua	Honomu	Honomu	Pepeekeo Sugar Co.
	Pepeekeo	Onomea	Onomea Sugar Co.
	Papaikou	Papaikou	Hilo Sugar Co.
	Wainaku	Hilo Town	Hawaii Mill Co.
	Punaluu	(Puna)	Waiakea Mill Co.
	Puako	Keaau (Nine Miles)	Olaa Sugar Co.
		Mountain View	(Kau and Kona)
		Pahoa	Hawaiian Agricultural Co.
		Kapoho	Hutchinson Sugar Plantation
		Kalapana	Kona Sugar Co.
		(Kau)	
		Pahala	
		Hilea	
		Honuapo	
		Naalehu	
		Waiohinu	
		(Kona)	
		Papa	
		Hookena	
		Honaunau	
		Napoopoo	
		Kainaliu	
		Keauhou	
		Holualoa	
		Kailua	

MAUI

CAPES	BAYS	PLACES	PLANTATIONS
Kahakuloa Point	Kahului	Lahaina	Pioneer Mill Co. (Lahaina)
Kauiki Head	Maalaea	Olowalu	Olowalu Co.
	Hana Bay	Waikapu	

MAUI — *Continued*

MOUNTAINS	HEIGHT
Haleakala	10,032 feet
Puu Kukui	5,788 feet
Eke	4,500 feet

LANDINGS

Kahului
Keanae
Nahiku
Hana
Kipahulu
Kaupo
Makena
McGregor (Maalaea Bay)
Olowalu
Lahaina
Kaanapali (Kekaa)
Honolua

PLACES

Wailuku
Waihee
Kahului
Puunene
Spreckelsville
Paia
Haiku
Hamakuapoko
Makawao
Pauwela
Huelo
Keanae
Hana
Kipahulu
Kaupo
Ulupalakua
Kihei

PLANTATIONS

Wailuku Sugar Co.
Hawaiian Commercial and Sugar Co.
Maui Agricultural Co. (Paia)
Kipahulu Sugar Co.
Kaeleku Plantation (Hana)

KAUAI

CAPES

Haena Point

BAYS

Hanalei Bay
Hanamaulu Bay
Nawiliwili Bay

MOUNTAINS	HEIGHT
Waialeale	5250 feet
Hoary Head (Haupu)	2030 feet
Kilohana Crater	1100 feet

LANDINGS

Nawiliwili
Ahukini
Kapaa
Anahola
Kilauea
Hanalei
Wainiha
Koloa
Eleele
Hanapepe
Makaweli
Waimea

PLACES

Lihue
Kapaia
Hanamaulu
Kapaa
Kealia
Anahola
Kilauea
Kalihiwai
Hanalei
Wainiha
Haena
Koloa
Lawai
Eleele
Hanapepe
Makaweli
Waimea
Kekaha

PLANTATIONS

Kilauea Sugar Plantation Co.
Makee Sugar Co. (Kealia)
Lihue Plantation Co.
Grove Farm Plantation (Planters only)
Koloa Sugar Co.
McBryde Sugar Co.
Hawaiian Sugar Co. (Makaweli)
Gay and Robinson (Planters only)
Waimea Sugar Mill Co.
Kekaha Sugar Co.

MOLOKAI

MOUNTAINS	HEIGHT
Kamakou	4958 feet
Olokui	4600 feet

LANDINGS
Kaunakakai
Kamalo
Pukoo

OTHER ISLANDS

	HEIGHT
Lanai	3400 feet
Kahoolawe	1472 feet
Molokini	160 feet
Niihau	1300 feet

APPENDIX B

DISTANCES

Honolulu to	MILES
Kalaupapa	52
Lahaina	72
Kahului	90
Hana	128
Maalaea	86
Makena	96
Mahukona	134
Kawaihae	144
Kailua on Hawaii	157
South Point (Ka Lae)	233
Honuapo	244
Hilo (direct)	192
Hilo (via Kawaihae)	230
Nawiliwili	98
Koloa	102
Waimea	120
Hanalei	125

APPENDIX C

	MILES WIDE
Oahu Channel (Kaiwi)	23
Molokai Channel (Pailolo)	8
Maui Channel (Auau)	7
Hawaii Channel (Alenuihaha)	26
Kauai Channel (Kaieie Waho)	63

APPENDIX D

	Area in Square Miles	Length in Miles	Width in Miles	Population 1900
Hawaii . . .	4015	90	74	46,843
Maui . . .	728	46	30	24,796
Oahu . . .	598	46	25	58,504
Kauai . . .	547	25	22	20,562
Molokai . .	261	40	9	2,504
Lanai . . .	139	21	8	619
Niihau . . .	97			172
Kahoolawe . .	69			
Total . .	6454			154,000

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APPENDIX F

PRONUNCIATION OF HAWAIIAN WORDS

A is sounded as in f*a*ther, *e* as in th*ey*, *i* as in mar*i*ne, *o* as in n*o*te, *u* as in r*u*le or as *oo* in m*oo*n.

Ai when sounded as a diphthong resembles the English *ay* in the word *aye* (yes), or the English *i* in b*i*te ; and *au* resembles the English *ou* in l*ou*d.

The accent of most of the words in the Hawaiian language is on the penult (the syllable next to the last). A few of the proper names are accented on the final syllable, as Hanapepė, Kamalō, Waikiki, etc. *W* is sometimes sounded as *v*.

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